2006 Status of the Nation's Highways, Bridges, and Transit:

Conditions & Performance

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U.S. Department of Transportation
Federal Highway Administration
Federal Transit Administration

REPORT TO CONGRESS
Executive Summary

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Introduction

This document is a summary of the *2006 Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance* report to Congress (C&P report). The C&P report is intended to provide decision makers with an objective appraisal of the physical conditions, operational performance, and financing mechanisms of highways, bridges, and transit systems based both on the current state of these systems and on the projected future state of these systems under a set of alternative future investment scenarios. This edition of the C&P report is the seventh in the series that combines information on the Nation's highway and transit systems.

The main body of the report is organized into four major sections. Part I, "Description of Current System," includes the core retrospective analyses in the report, including chapters on the role of highways and transit, system and usage characteristics, physical conditions, operational performance, safety performance, and finance.

Part II, "Investment/Performance Analysis," includes the core prospective analyses of the report, including projections of future highway, bridge, and transit capital investment under certain defined scenarios. This section also explores how these scenarios would be affected by changing the assumptions about travel growth, financing mechanisms, and other key variables.

The highway investment scenarios presented in this report are developed in part from the Highway Economic Requirements System (HERS), which uses marginal benefit-cost analysis to optimize highway investment. The HERS model quantifies user, agency, and societal costs for various types and combinations of improvements, including travel time, vehicle operating, safety, capital, maintenance, and emissions costs.

Bridge investment scenario estimates were developed from the National Bridge Investment Analysis System (NBIAS) model, which was used for the first time in the 2002 edition of the C&P report. Unlike previous bridge models (and similar to HERS), NBIAS incorporates benefit-cost analysis into the bridge investment/performance evaluation.

The transit investment analysis is based on the Transit Economic Requirements Model (TERM). The TERM consolidates older engineering-based evaluation tools and introduces a benefit-cost analysis to ensure that investment benefits exceed investment costs. Specifically, TERM identifies the investments needed to replace and rehabilitate existing assets, improve operating performance, and expand transit systems to address the growth in travel demand and then evaluates these needs in order to select future investments.

Part III, "Special Topics," explores further some topics related to the primary analyses in the earlier sections of the report. Some of these chapters reflect recurring themes that have been discussed in previous editions of the C&P report, while others address new topics of particular interest that will be included in this edition only. Part IV, "Afterword: A View to the Future," identifies potential areas for improvement in the data and analytical tools used to produce the analyses contained in this report, and describes ongoing research activities.

Highlights

In order to correctly interpret the analyses presented in this report, it is important to understand the framework in which they were developed and to recognize their limitations. As stated in the "Introduction," this document is intended to provide Congress with an objective appraisal of the physical conditions, operational performance and financing mechanisms of highways, bridges, and transit systems based both on the current state of these systems and on the projected future state of these systems under a set of alternative future investment scenarios. The trends identified in this report reflect more recent data than the last edition, as well as enhancements to the analyses based on ongoing work by the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) to improve the estimation of the conditions and performance of highways, bridges, and transit and to forecast the impact that future investment may be expected to have on maintaining and improving this transportation infrastructure.

Since this edition of the C&P report is based primarily on data through the year 2004, it does not reflect any effects of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), which authorized Federal highway and transit funding for Federal fiscal years 2005 through 2009. This "Highlights" section generally compares 2004 statistics with those for 1997, the last year preceding the enactment of the Transportation Equity Act for the 21st Century (TEA-21). As discussed in the "Introduction," other sections within this report assess recent trends over different time periods.

Cautionary Note on Using This Report

It is important to note that this document is not a statement of Administration policy and that the future investment scenarios presented in this report are intended to be illustrative only. **The report does not endorse any particular level of future highway, bridge, or transit investment;** it does not address questions as to what future Federal surface transportation programs should look like, or what level of future surface transportation funding can or should be provided by the Federal government, State governments, local governments, the private sector, or system users. Making recommendations on policy issues such as these would go beyond the legislative mandate for the report and would violate its objectivity. During the legislative development process culminating in SAFETEA-LU, a certain figure was widely cited as being the six-year Federal program size recommended by the 2002 C&P report; however, that figure did not actually appear anywhere in the report. Outside analysts can and do make use of the statistics presented in the C&P report to draw their own conclusions, but any analysis attempting to use the information presented in this report to determine a target Federal program size would require a whole series of additional policy and technical assumptions that go well beyond what is reflected in the report itself.

What is a "Need"?

The current legislative requirement for an "Infrastructure Investment Needs Report" in 23 USC 502(h), and the comparable legislative requirements for this type of report in the past (dating back to 1968 on the highway side and 1984 on the transit side), do not define exactly what a "need" is; economists largely reject a concept of a "need" that is divorced from demand and price considerations. Despite this, the report series began as a combined "wish list" of State highway needs. Over time, national engineering standards were defined and utilized to develop a set of "needs" on a uniform national basis. As the report series evolved further, economic considerations were brought into the analysis, looking at the impact of system conditions and performance on highway and transit users as well as on highway agencies and transit operators. The current generation of analytical tools attempt to combine engineering and economic procedures, determining deficiencies based on engineering standards while applying benefit-cost analysis procedures to identify potential capital improvements to address those deficiencies that may have positive net benefits.

The investment scenario estimates presented in this report represent an estimate of what level of performance **could** be achieved with a given level of funding, not what **would** be achieved with it. While the models assume that projects are prioritized based on their benefit-cost ratios, that assumption is not consistent with actual patterns of project selection and funding distribution that occur in the real world. Consequently, the level of investment identified as the amount required to maintain a certain performance level should be viewed as the minimum amount that would be required, if all other modeling assumptions prove to be accurate.

It is important to note that the benefit-cost analysis procedures currently employed are not equally robust among all of the different types of infrastructure investments covered in this report. Further, this approach does not subject potential capital improvements to the type of rate of return analysis that would typically be employed in the private sector. The Department continues to look for ways to address the limitations of the existing analytical procedures.

Uncertainty in Transportation Investment/Performance Modeling

As in any modeling process, simplifying assumptions have been made to make analysis practical and to meet the limitations of available data. Since the ultimate decisions concerning highways, bridges, and transit systems are primarily made by their owners at the State and local level, they have a much stronger business case for collecting and retaining detailed data on individual system components. The Federal government collects selected data from States and transit operators to support this report, as well as a number of other Federal activities, but these data are not sufficiently robust to make definitive recommendations concerning specific transportation investments in specific locations. While potential improvements are evaluated based on benefit-cost analysis, not all external costs (such as noise pollution) or external benefits (such as the impact of transportation investments on productivity) are fully considered. Across a broad program of investment projects such external effects are likely to cancel each other; but, to the extent that they do not, the true "needs" may be either higher or lower than would be predicted by the models. This topic is discussed in the Introduction to Part II.

A State or local government performing an investment analysis for a real-world project would presumably have better information concerning the capital costs associated with the project, as well as localized information that would influence the evaluation of the project's potential benefits and external societal costs. To the extent that State and local governments include other factors in their investment decision-making process beyond just economic considerations, benefit-cost ratios will not be maximized. In fact, there is mounting evidence that the benefit-cost ratios of highway and public transportation investments have declined significantly in recent years. Moreover, current processes and approaches do little to ensure that investment resources are appropriately targeted.

Impact of Financing Structures on Transportation Investment/Performance Analysis

This report has traditionally identified the amount of additional spending above current levels that would be required to achieve certain performance benchmarks, without incorporating the impact of the types of revenues that would support this additional spending. This approach was in keeping with the general philosophy referenced earlier that the assignment of responsibility for the costs associated with a given scenario to any particular level of government or funding source falls beyond the legislative mandate for this report. However, the implicit assumption built into this approach has been that the financing mechanisms would not have any impact on investment scenarios themselves. In reality, however, increasing funding from general revenue sources (such as property taxes, sales taxes, income taxes, etc.) would have different implications than increased funding from user charges (such as fuel taxes, tolls, and fares). For this report, the modeling procedures for estimating the highway investment scenarios have been modified to assume that the funding to support increases in highway and bridge investment above 2004 levels would be financed in a manner consistent with the current financing structure, which is primarily supported by user fees. A feedback loop has also been added to account for the impact that this change in the "price" of travel experienced by individual system users would have on projected future travel volumes and the future investment scenario estimates.

While the assumption of increased levies on users via the current tax and fee structure draws revenues, investment, and travel demand together, the inherent economic inefficiencies of the current structure would remain, whereby travel on uncongested facilities is charged at the same rate as those with significant congestion issues. Previous editions of this report have identified congestion pricing as an alternative financing and travel demand management tool that could significantly improve economic efficiency and reduce the distortionary effect that the current financing structure has on highway use and investment.

When highway users make decisions about whether, when, and where to travel, they consider both the implicit costs (such as travel time and safety risk) and explicit, out-of-pocket costs (such as fuel costs and tolls) of the trip. Under uncongested conditions, their use of the road will not have an appreciable effect on the costs faced by other users. As traffic volumes begin to approach the carrying capacity of the road, however, traffic congestion and delays begin to set in and travel times for all users begin to rise, with each additional vehicle making the situation progressively worse. However, individual travelers do not take into account the delays and additional costs that their use of the facility imposes on other travelers, focusing instead only on the costs that they bear themselves. To maximize net social benefits, users of congested facilities would be levied charges precisely corresponding to the economic cost of the delay they impose on one another, thereby more efficiently spreading traffic volumes and allowing the diverse preferences of users to be expressed. In the absence of efficient pricing, options for reducing congestion externalities and increasing societal benefits are limited. In addition, the efficient level of investment in highway capacity is larger under the current system of highway user charges (primarily fuel and other indirect taxes) than would be the case with full-cost pricing of highway use.

For this report, the Highway Economic Requirements System (HERS) has been adapted to illustrate the theoretical impact that more efficient pricing could have on the future highway investment scenario estimates. This preliminary analysis, presented in Chapter 10, assumes that congestion pricing would be implemented universally on all congested roads. As discussed below, improving the economic efficiency of the highway pricing structure would yield significant benefits in the form of reduced congestion and traveler delay. The methodology used for this analysis is presented in greater detail in Appendix A. The "Pricing Effects" section in Part IV of this report also provides a further discussion of other ongoing research activities in this area that will be reflected in future editions of this report.

While the above discussion focuses on highway pricing, the same considerations may apply to transit investments. Anecdotal evidence suggests that transit routes in major metropolitan areas are approaching their passenger-carrying capacities during peak travel hours, with a commensurate deterioration in the quality of service. Some of this crowding could be reduced by increasing fares during peak hours. Certain considerations, however, may limit the ability of transportation authorities to price transit services more efficiently, such as the ability of the fare system to handle peak pricing, and the desire to provide transit as a low-cost service to transit-dependent riders. Additionally, the fact that overcrowded transit lines are often in corridors with heavily congested highways makes a joint solution to the pricing problems on both highways and transit more complicated to analyze, devise, and implement. Measuring the actual crowding on transit systems during peak periods, and the development of a more sophisticated crowding metric than the one currently used by FTA, are areas for further research.

Impact of New Technologies

The highway investment analysis procedures used to develop the investment scenarios for this report have been modified to reflect the impact that certain types of operational strategies and intelligent transportation systems (ITS) deployments may have on system performance in the future, based on current deployment trends. However, any more aggressive and effective deployment of ITS and other technologies beyond that which has been modeled in this analysis is expected to further reduce the level of future capacity investment that would be required to achieve any specific level of performance. The sensitivity analysis in Chapter 10 explores the potential impacts of more rapid deployment of existing technologies.

New technology holds promise in other areas as well. Improved pavement and bridge technologies have the potential to reduce future system rehabilitation costs, while improved highway and transit vehicle technologies could interact with ITS deployments to further improve operating efficiency. This report does not attempt to assume the future impacts of these types of technological improvements, but it is important to recognize their potential when considering the findings of this report. A discussion of new technologies is included in Part IV.

What Does it Mean to "Maintain"?

Due to the nature of the different analytical tools to analyze highway, bridge, and transit investment for this report, and the limitations of the underlying data, the "maintain" scenarios are defined differently in this report for different system components. The Cost to Maintain highways reflects the estimated average annual level of investment required so that the physical conditions and operational performance of the highway system will remain at a level such that their impact on highway users (measured in terms of average costs experienced by users) in 20 years would be the same as today. The Cost to Maintain bridges reflects the estimated level of investment that would be sufficient to keep the backlog of economically justifiable bridge improvements in 20 years at the same size as it is today. The Cost to Maintain transit reflects the estimated level of investment that would be sufficient to keep the average transit asset condition in 20 years equal to the average transit asset condition in the base year, and to have the average occupancy rate for each mode, as measured by passenger miles per peak vehicle, the same in 20 years as in the base year.

While the analytical approaches differ, all of these scenarios point to a level of investment that could keep the conditions and performance of the overall system 20 years from now in roughly the same shape that it is in today. However, it is important to recognize that the conditions of "today" (i.e., 2004) in this report differ from the conditions of "today" (i.e., 2002) as presented in the 2004 edition of the report. Hence, as the level of current system conditions and performance varies over time, the investment scenarios that are based on maintaining the status quo are effectively targeting something different each time. It is important to recognize this when comparing the results of different reports in the series.

It is also important to note that the investment scenario estimates outlined in this report represent an estimate of what level of performance **could** be achieved with a given level of funding, not what **would** be achieved with it. While the models assume that projects are prioritized based on their benefit-cost ratios, that assumption is not consistent with actual patterns of project selection and funding distribution that occur in the real world. Consequently, the level of investment identified as the amount sufficient to maintain a certain performance level should be viewed as the minimum amount that would be sufficient, if all other modeling assumptions prove to be accurate.

What Does it Mean to "Improve"?

In theory, if the estimated Cost to Maintain level is accurate, and the "correct" projects are chosen, then spending $1 more than that level would result in an improved system. In practice, the "Cost to Improve" scenarios in this report have been more aggressive, picking some higher target level of future conditions and performance. The Cost to Improve highways (described as the "Maximum Economic Investment" scenario) reflects the maximum average annual level of investment that could be utilized while still investing only in cost-beneficial highway improvements over 20 years. The Cost to Improve bridges reflects the estimated level of investment that would be sufficient to eliminate the backlog of economically justifiable bridge improvements by the end of 20 years. The Cost to Improve transit reflects the estimated level of investment that would be sufficient to accelerate the rehabilitation and replacement of transit assets to achieve the following objectives: (1) to reach an average condition of "good" for transit assets at the end of the 20-year period, (2) to reduce vehicle occupancy levels in agency-modes with occupancy levels one deviation above the national average to that level, and (3) to increase speeds in urbanized areas with average speeds one deviation below the national average to that level by investing in new rail or bus rapid transit service. [Note the term agency-mode refers to each mode within each transit agency.] In this report, the Cost to Improve transit comes close to, but does not fully achieve, an average condition of "good" for transit assets, because to do so would require replacing assets that are still in operationally acceptable condition.

Particularly for highways and bridges, the "Cost to Improve" scenarios in this report can be viewed as "investment ceilings" above which it would not be cost beneficial to invest, even if unlimited funding were available. The transit scenario is predicated on the ambitious condition and performance criteria specified above. While these scenarios are interesting from a theoretical technical standpoint, they do not represent practical target levels of investment, for several reasons. First, available funding is not unlimited, and many decisions on highway and transit funding levels must be weighed against potential cost-beneficial investments in other government programs and across various industries within the private sector that would produce more benefits to society. Simple cost-benefit analysis is not a commonly utilized capital investment model in the private sector. Instead, firms utilize a rate of return approach and compare various investment options and their corresponding risk. In other words, a project that is barely cost-beneficial would almost certainly not be undertaken when compared to an array of investment options that potentially produce higher returns at equivalent or lower risk. Second, these scenarios do not address practical considerations as to whether the highway and transit construction industries would be capable of absorbing such a large increase in funding within the 20-year analysis period. Such an expansion of infrastructure investment could significantly increase the rate of inflation within these industry sectors, a factor that is not considered in the constant dollar investment analyses presented in this report. Third, the legal and political complexities frequently associated with major highway capacity projects might preclude certain improvements from being made, even if they could be justified on benefit-cost criteria. In particular, the time required to move an urban capacity expansion project from “first thought” to actual completion may well exceed the 20-year analysis period.

It is important to again note that, while the models assume that projects are prioritized based on their benefit-cost ratios, that assumption is not consistent with actual patterns of project selection and funding distribution that occur in the real world. Consequently, if investment rose to the Cost to Improve level, there are few mechanisms to ensure these funds would be invested in projects that would be cost-beneficial. As a result, the impacts on actual conditions and performance may be far less significant than what is projected as part of this scenario.

Highlights: Highways and Bridges

Combined investment by all levels of government in highway and bridge infrastructure has increased sharply since TEA-21 was enacted. Total highway expenditures by Federal, State, and local governments increased by 44.7 percent between 1997 and 2004, to $147.5 billion. This equates to a 22.7 percent increase in constant dollar terms. Highway capital spending alone rose from $48.4 billion in 1997 to $70.3 billion in 2004, a 45.2 percent increase, equating to a 22.9 percent increase in constant dollar terms. Federal cash expenditures for highway capital purposes increased 52.9 percent from 1997 to 2004, while State and local capital investment increased by a smaller (though still robust) rate of 39.9 percent (increases of 29.4 and 18.3 percent in constant dollar terms, respectively). It is important to note that, owing to the nature of the Federal-aid highway program as a multiple-year reimbursable program, the impact of increases in obligation levels phases in gradually over a number of years. The Federally funded portion of total highway capital investment for all levels of government had dipped below 40 percent in 1998 for the first time since 1959, as TEA-21’s passage relatively late in fiscal year 1998 reduced its impact on cash expenditures during that initial year. However, this share subsequently rebounded sharply, reaching 46 percent in 2002 (consistent with the high end of the range of 41 to 46 percent that was observed for each year between 1987 and 1997) before tailing off to 44 percent in 2004.

The TEA-21 era has also coincided with a shift in the types of capital improvements being made by State and local governments. The percentage of capital investment going for “system rehabilitation” (the resurfacing, rehabilitation, or reconstruction of existing highway lanes and bridges) increased from 47.6 percent in 1997 to 51.8 percent in 2004. The combined result of the increase in total capital investment and the shift in the types of improvements being made was a 58 percent increase (33.9 percent in constant dollar terms) in spending on system rehabilitation, from $23.0 billion in 1997 to $36.4 billion in 2004. Compared with system expansion projects, system rehabilitation projects tend to have shorter lead times and are often less controversial, which made many of them attractive candidates as Federal funding increased over this period. Investment in system expansion (the construction of new roads and bridges and the widening of existing roads) grew more slowly during this period, rising 28 percent (8.3 percent in constant dollar terms) from $21.5 billion in 1997 to $27.5 billion in 2004.

Physical Conditions Have Improved in Some Areas

The large increase in system preservation investment since 1997 has had a positive effect on the overall physical condition of the Nation's highway and bridge infrastructure. The percentage of vehicle miles traveled (VMT) on pavements with "good" ride quality rose from 39.4 percent in 1997 to 44.2 percent in 2004. Rural areas showed the most improvement, as the share of rural VMT on roads with good ride quality rose from 47.9 percent to 58.3 percent over the same period. It should be noted that the share of VMT on roads with "acceptable" ride quality (a lower standard that includes roads classified as "good") has fallen from 86.4 percent to 84.9 percent, mainly due to a decline in urbanized areas. (The preceding figures are based on all arterials and collectors for which data are available).

The percentage of bridges considered deficient dropped from 29.6 percent in 1998 to 26.7 percent in 2004, with most of the progress made on bridges with structural deficiencies, rather than on bridges considered to be functionally obsolete. Bridge condition also differs by functional system. For example, the percentage of Interstate bridges classified as structurally deficient or functionally obsolete is lower than the comparable percentages for bridges on collectors or local roads.

The National Highway System (NHS) includes those roads that are most important to interstate travel, economic expansion, and national defense. While the NHS makes up only 4.1 percent of total mileage, it carries 44.8 percent of total travel in the United States. The physical conditions of NHS routes are better on average than other roads. The percentage of NHS VMT on pavements with "good" ride quality rose from 37 percent in 1997 to 52 percent in 2004. The percentage of NHS bridges considered deficient dropped from 26.1 percent in 1997 to 20.5 percent; almost three-fourths of these bridges are functionally obsolete, while only one-fourth are structurally deficient.

Operational Performance Has Declined, But at a Slower Rate

Despite the historic investment in highway infrastructure and improving conditions on many roads and bridges, operational performance—the quality of use of that infrastructure—has continued to deteriorate. This is reflected in measures of congestion in all urbanized areas developed for FHWA by the Texas Transportation Institute (TTI). From 1997 to 2004, the estimated percentage of travel occurring under congested conditions has risen from 27.4 percent to 31.6 percent. The average length of congested conditions has risen from 6.2 hours per day in 1997 to 6.6 hours per day. [Note that these statistics are different than those found in TTI's annual *Urban Mobility Study*, which is based on a subset of urbanized areas weighted toward the most heavily populated areas.] On a more positive note, the rate at which these indicators are getting worse has been slowing in recent years.

The Department of Transportation's (DOT) *National Strategy to Reduce Congestion on America's Transportation Network* provides a blueprint for Federal, State, and local officials to follow in addressing critical operational performance issues. Several of the topics identified in the plan are also discussed in this report, including congestion pricing, freight bottlenecks, the deployment of new technologies to improve operations, and private sector partnering and financing opportunities. Congestion mitigation is also a major component of the *Framework for a National Freight Policy* that has been developed by DOT and its public and private partners.

Highway Safety Has Improved

Considerable progress has been made in reducing fatality rates and injury rates over time, including the period from 1997 through 2004. The fatality rate per 100 million VMT has declined from 1.64 to 1.44 over that period, but increased to 1.47 in 2005. The actual umber of highway fatalities has remained relatively constant over this period, remaining in a range from 41,500 to 43,500 per year. The injury rate per 100 million VMT declined from 131 in 1997 to 94 in 2004.

Highway safety remains a top priority within the DOT, and the improvement of the Nation's roadway infrastructure is an important component of the effort to reduce highway fatalities and injuries.

Future Investment Scenarios

Absent increased implementation of congestion pricing, accelerated deployment of operational technologies, or any innovation in construction methods or materials, maintaining the overall conditions and performance of highways and bridges at current levels would require an increase in the combined amount of investment from all levels of government and the private sector, relative to current expenditures. The "Cost to Maintain Highways and Bridges" scenario describes a level of investment at which future conditions and performance would be maintained at a level sufficient to keep average highway user costs from rising above their 2004 levels, based on projections of future highway use. The average annual investment level for this scenario is projected to be $78.8 billion (in constant 2004 dollars) for 2005 to 2024, which is 12.2 percent more than the $70.3 billion of capital spending in 2004. Note that this "gap" reflects future investments stated in constant dollars; additional annual increases in investment would be necessary to offset the effects of inflation. Note also that capital expenditures for bridge preservation in recent years have exceeded the bridge preservation component of the "Cost to Maintain Highways and Bridges" scenario, a trend that has led to reductions in the percentage of bridges classified as deficient. [See the "What Does it Mean to 'Maintain'?" section earlier in these Highlights for critical caveats to consider in evaluating the implications of this scenario.]

Assuming resources are deployed to maximize net benefits as opposed to achieve other non-economic objectives, additional increases in highway capital investment would result in positive net benefits to the American public through further reductions in travel time, vehicle operating costs, crashes, emissions, and highway agency costs. The "Maximum Economic Investment (Cost to Improve Highways and Bridges)" scenario presented in this report describes an "investment ceiling" above which it would not be cost beneficial to invest. The average annual Maximum Economic Investment level is projected to be $131.7 billion for 2005 to 2024 (stated in constant 2004 dollars). This is 87.4 percent higher than the $70.3 billion of total capital investment by all levels of government in 2004. As stated previously, however, current investment methodologies do little to ensure maximization of net benefits. [See the "What Does it Mean to 'Improve'?" section earlier in these Highlights for critical caveats to consider in evaluating the implications of this scenario.]

The investment scenario estimates in this report are slightly higher than the estimates for 2003 to 2022 found in the 2004 edition of this report, due largely to the impact of inflation in highway construction costs between 2002 and 2004. Accounting for inflation, the estimated Cost to Maintain is 2.3 percent greater, while the estimated Maximum Economic Investment level for highways and bridges is 6.2 percent higher. These other changes in projected investment scenario estimates from the 2004 report are attributable both to changes in the underlying characteristics, conditions, and performance of the highway system as reported in the available data sources, and to changes in the methodology and models used to generate the estimates.

Impacts of Future Investments

In addition to the two main investment scenarios outlined above, this report also predicts the impacts of numerous alternative future investment levels on a variety of condition and performance indicators.

If investment were to remain at 2004 levels in constant dollar terms, and no additional operational strategies or innovations are implemented beyond those assumed as part of the scenarios, it is projected that recent trends observed in the conditions and performance of the highway system would continue. At this range of investment levels, and assuming current tax and fee structures for system users, the operational performance of the highway system is expected to further deteriorate: average speeds would decline and the amount of delay experienced by drivers would increase. Recent trends toward improvements in bridge conditions are expected to continue; however, the aging of the Nation's bridges, particularly on the Interstate System, will present additional challenges in the future.

Composition of Future Investments

The analyses of future investment/performance relationships in this report suggest that (1) there is substantial room for cost-beneficial investment in system rehabilitation that would reduce average highway user costs and (2) if funding levels were to be raised significantly, an increasing number of potential system capacity investments would be among the most cost-beneficial options.

The recommended mix of investments under the "Cost to Maintain" scenario is very similar to current spending patterns in terms of the relative percentages of investments in system rehabilitation compared with system expansion. However, the "Maximum Economic Investment for Highways and Bridges" scenario would devote a larger share of total investment toward capacity expansion than would the "Cost to Maintain" scenario. While capacity improvements are generally more expensive than rehabilitation improvements, proportionally more of them could be economically justified at high levels of investment.

Potential Impacts of Congestion Pricing

This edition of the C&P report includes some preliminary analysis estimating the potential impacts of applying universal congestion pricing to all congested roadways. This underlying analytical approach will be refined further and peer reviewed by outside experts prior to the development of the 2008 C&P report; future reports will include pricing scenarios that may show larger or smaller effects. However, from even this preliminary analysis, it is clear that **congestion pricing has the potential to significantly improve the operational performance of the Nation's highway system, while significantly reducing the level of future capital investment that would be necessary to achieve any specific level of performance**. Instituting congestion pricing on a widespread basis would also send clear signals concerning travelers' willingness to pay to travel in certain corridors at certain times, which would inform decisions about where future capital investment should be directed in order to maximize net benefits. Such signals would be expected to improve the transportation planning process.

The application of universal congestion pricing to the "Cost to Maintain" scenario would reduce the average annual investment level by $21.6 billion (27.5 percent) to $57.2 billion. This is well below the $70.3 billion of capital spending by all levels of government in 2004. The congestion tolls applied under this scenario would average 20.5 cents per mile, based on the estimated economic costs that individual users of congested facilities impose on one another in terms of increased delay. On some extremely congested sections, the optimal congestion tolls would be considerably higher, while the optimal congestion tolls would be lower on less congested sections. No congestion tolls were applied to uncongested highway sections.

The application of universal pricing to the "Maximum Economic Investment" scenario would both reduce the average annual investment level by $20.9 billion (15.9 percent) to $110.8 billion, and improve the overall operating performance of the highway system, reducing the average delay experienced by highway users. Since the overall level of congestion would be lower under this scenario than under the "Cost to Maintain" scenario, individual drivers have less of a negative impact on each other, causing the average congestion tolls applied under this scenario to be lower, averaging 17.4 cents per mile.

The estimated annual revenues produced by the congestion tolls are approximately $34 billion for the "Maintain" scenario and $24 billion for the "Maximum Economic Investment" scenario. Average toll rates and annual revenues would be higher in the latter portions of the 20-year analysis period, as baseline traffic levels increase and contribute to congestion. The larger average tolls and revenues under the "Maintain User Cost" scenario reflect the fact that congestion would be higher under this scenario, so that drivers have larger negative impact on each other. For the "Maximum Economic Investment" scenario, the additional capacity expansion at the higher investment levels result in reduced congestion, so that drivers' impact on each other is not as severe; thus, the efficient congestion toll rates would be lower. This analysis suggests an important dichotomy between the revenues that would be produced under congestion pricing if tolls were levied in the manner assumed in this scenario and the revenues that would be required to support increased investment levels; in fact, the two are in some sense counter to one another. Note that this dichotomy might not exist under alternative approaches to setting congestion-based tolls, such as maximizing the estimated revenue yield. Such alternative approaches would affect the level of revenues produced, but would also change the impact of the congestion tolls on the investment scenario estimates.

Note that this preliminary analysis does not take into account the start-up or administrative costs that would be required to implement a congestion pricing strategy of this nature. The level of these costs could vary significantly, depending on the type of technology employed to collect these tolls.

Highlights: Transit

Record levels of Federal investment in transit under TEA-21 were not only matched, but exceeded by the combined investments of State and local governments from 1997 through 2004. Total funding by Federal, State, and local governments reached its highest level of $28.4 billion in 2002, a 62.6 percent increase in current dollars from $17.5 billion in 1997, equal to a 45.6 percent increase in constant dollar terms. Federal funding in current dollars increased by 46.7 percent, from $4.7 billion in 1997 to $7.0 billion in 2004, equal to a 31.3 percent increase in constant dollar terms. State and local funding in current dollars increased by 68.5 percent, from $12.7 billion in 1997 to $21.5 billion in 2004, equal to a 50.9 percent increase in constant dollar terms. Total funding for transit, including system-generated revenues, increased by 52.2 percent, from $26.0 billion in 1997 to $39.5 billion in 2004, an increase of 36.3 percent in constant dollars.

In 2004, total transit agency expenditures for capital investment were $12.6 billion in current dollars, accounting for 33.2 percent of total transit spending. Federal funds provided $4.9 billion of total transit agency capital expenditures, State funds provided $1.8 billion, and local funds provided $5.9 billion. Capital investment funding for transit from the Federal government increased by 19.1 percent from 1997 to 2004, and capital investment funding for transit from State and local sources increased by 120.0 percent from 1997 to 2004. Due to the sharp increase in transit capital funds from State and local sources, the Federal government's portion of total transit capital investment from all levels of government fell from 54.2 percent in 1997 to 39.0 percent in 2004. Federal funding for transit capital investment was $4.1 billion in 1997 and $4.9 billion in 2004.

Transit Infrastructure Has Expanded

The significant growth in total capital investment under TEA-21 is reflected in an expansion of the Nation's transit infrastructure. Between 1997 and 2004, the number of active urban transit vehicles as reported to the National Transit Database increased by 18.0 percent, from 102,258 to 120,659. Track mileage grew by 9.8 percent, from 9,922 miles in 1997 to 10,892 miles in 2004. The number of stations increased by 10.4 percent, from 2,681 in 1997 to 2,961 in 2004; and the number of urban maintenance facilities increased by 8.8 percent, from 729 in 1997 to 793 in 2004.

Transit Use Has Increased

With new and modernized transit vehicles and facilities, passenger use has also increased, particularly transit rail use. Passenger miles traveled (PMT) on transit increased by 15.8 percent, from 40.2 billion in 1997 to 46.5 billion in 2004 (compared to an 18.1 percent increase in PMT on highways over the same period). PMT on nonrail transit (primarily buses) increased by 9.6 percent, from 19.0 billion in 1997 to 20.9 billion in 2004. PMT on rail increased by 21.4 percent, from 21.1 billion in 1997 to 25.7 billion in 2004. The distance traveled by all transit vehicles in revenue service, adjusted for differences in carrying capacities, increased by 27.2 percent, from 3.5 billion full-capacity bus miles in 1997 to 4.5 billion equivalent miles in 2004.

Physical Conditions for Most Assets Have Improved

Bus and rail vehicle conditions have improved since 1997. On a rating of 1 (poor) to 5 (excellent), bus vehicle conditions increased from 2.94 in 1997 to 3.08 in 2004, and rail vehicle conditions increased from 3.42 in 1997 to 3.50 in 2004.

Bus facility conditions improved from 3.23 in 2000 to 3.41 in 2004. Average condition is not available for 1997. Sixty-nine percent of bus maintenance facilities were in adequate (3) or better condition in 2004, compared with 67 percent in 2000 and 77 percent in 1997. Rail facility conditions improved from 3.18 in 2000 to 3.82 in 2004. As with buses, average condition is not available for 1997. Ninety-two percent of rail facilities were estimated to be in adequate or better condition in 2004, compared with 80 percent in 2002 and 77 percent in 1997. [Note that the deterioration schedules used to estimate 1997 facility conditions were revised and that 1997 conditions are not directly comparable to those for 2002 and 2004.]

Between 2002 and 2004, the conditions of track, structures, and yards improved. The percentage of communications systems and traction power systems in adequate or better conditions increased between 2002 and 2004, and the percentage of train control systems in adequate or better condition decreased. The conditions of rail stations improved from 2.87 in 2002 to 3.84 in 2004. The conditions of nonrail stations, which are assumed to follow the same deterioration schedule as light rail stations, declined from 4.37 in 2002 to 4.23 in 2004. The changes in the conditions of nonvehicle assets reflect both actual changes and changes based on new information. The nonvehicle transit asset data used by FTA to estimate conditions are updated for selected operators with each report cycle. Most of this information is not reported to the NTD and must be collected directly from transit agencies.

Operational Performance

FTA analyzes speed and vehicle utilization on the basis of the direction of their change only, as the optimal levels are unknown. While transit speed and utilization are frequently inversely related, this relationship may not always hold; it appears to hold most consistently for major rail modes. Vehicle speed on nonrail modes may be affected by road congestion, and capacity utilization may be affected by changes in agency-reported vehicle passenger-carrying capacities.

Vehicle speed is calculated by dividing vehicle revenue miles by vehicle revenue hours and, therefore, takes into account the effects of the number of stops, vehicle dwell times, road congestion, and operational deficiencies on average vehicle speed. In 2004, average vehicle speed was 20.1 miles compared with 19.9 miles per hour in 2002 and 20.3 miles per hour in 1997. Average nonrail vehicle speed was 13.8 miles per hour in 1997, decreasing to 13.7 miles per hour in 2002, and increasing to 14.0 miles per hour in 2004. Average rail vehicle speed declined from 26.1 miles per hour in 1997 to 24.9 miles in 2000, increasing steadily to 25.4 miles per hour in 2003, and then declining to 25.0 miles per hour in 2004.

Vehicle utilization is measured by the ratio of passenger miles traveled to vehicles operated in maximum service adjusted to take into account differences in vehicle capacity. The utilization of heavy rail, commuter rail, and light rail increased from 1997 to 2000 and declined from 2001 to 2003, moving inversely with rail speeds. As the utilization of heavy rail and commuter rail continued to increase from 2003 to 2004, average rail speed decreased, outweighing a continued decline in light rail utilization.

Vehicle utilizations of all major nonrail modes were lower in 2002 than in 1997. The utilizations of motorbus and trolleybus vehicles continued to decline from 2002 to 2004, while the utilizations of demand response, vanpool, and ferryboat vehicles increased.

Future Investment Scenarios

The estimated average annual "Cost to Maintain" transit asset conditions and operating performance is estimated to be $15.8 billion, 25.4 percent more than 2004 capital spending. Asset rehabilitation and replacements account for between 49 percent and 66 percent of these projected funding requirements. Asset rehabilitation and replacements would account for a larger portion of total investment if performance is maintained and a smaller portion if performance is improved. These investment scenario estimates have not changed materially from $15.6 billion, the amount estimated for the 2004 C&P report.

This estimated $15.8 billion investment to maintain transit conditions and performance is based on maintaining transit asset conditions and on expanding service to meet an increase in ridership of 1.57 percent per year. This amount is unlikely to have much of an impact of transit's share of total passenger travel or to draw many passengers from highways to transit given that growth on both is expanding.

Eighty-seven percent of the projected transit investment under this scenario is expected to be in urban areas with populations over 1 million, and 92 percent of PMT on transit systems are in these areas. Fifty-eight percent of the total amount needed to maintain conditions and performance, or $9.0 billion dollars annually, is estimated to be for rail infrastructure. In 2004 PMT on rail accounted for 55 percent of PMT on transit. Vehicles account for the highest proportion, but less than half, of projected capital outlays for both rail and nonrail modes. Guideways account for almost as much of the estimated investment under this scenario as vehicles. Changes in investment needs by asset type have not changed materially from those reported in the 2004 C&P report.

The average annual Cost to Improve both the physical condition of transit assets and transit operational performance to targeted levels by 2024 is estimated to be $21.8 billion in constant 2004 dollars, 73.0 percent higher than transit capital spending of $12.6 billion in 2004. This scenario is an upper limit of the economically justifiable level of transit investments. The scenario assumes that all assets are close to good condition (4) by the end of the investment period. Eighty-seven percent of the additional amount for the Cost to Improve, or $5.2 billion annually, is to increase average operating speeds as experienced by passengers and to lower average vehicle occupancy levels to threshold levels by 2024, by undertaking investments in systems with slower passenger speeds and higher occupancy rates.

The projected investment scenarios are sensitive to forecasts of PMT. The investment scenario estimates presented in this report are based on an average annual increase in ridership of 1.57 percent, an average of transit travel forecasts from 92 metropolitan planning organizations (MPOs). The previous report used projected growth of 1.57 percent per year based on the forecasts of 76 MPOs. The projected rate is above the actual 0.65 percent average annual rate of growth between 2000 and 2002, but below the actual average annual growth of 2.29 percent occurring between 1995 and 2004.

Conclusion

Increased Federal funding for transit capital investment under TEA-21, combined with a substantial increase in State and local government funding, has expanded transit infrastructure and permitted the condition of most transit assets to be maintained or improved between 1997 and 2004. PMT increased substantially from 1997 to 2004, but more slowly between 2000 and 2004. Vehicle utilization rates for most modes peaked in 2000 or 2001, leading to lower passenger travel speeds. Passenger speeds were slightly higher in 2002 and 2004, reflecting utilization levels below the 2000 and 2001 peaks. Since 2003 the utilizations of heavy rail and commuter rail have increased, leading to a decrease in average rail speed. The amount to maintain conditions and performance has increased marginally in current dollars from the amount in the 2004 C&P report, but declined in real dollars; the slight downward revision in amount required to maintain conditions and performance resulted from revisions to maintenance facility replacement costs and station replacement costs, revisions to asset deterioration schedules for stations and systems, and improvements to the benefit-cost analysis and new NTD data. The amount to improve conditions and performance declined by about $3.0 billion from the amount in the 2004 C&P report, principally due to a downward revision in the estimated cost of congestion delay to align more closely with the *1997 Federal Highway Cost Allocation Study* and reflect congestion levels by population stratum.

The Role of Highways and Transit

Highways and transit are crucial components of the U.S. public infrastructure and play vital roles in maintaining the vigor of the U.S. economy.

The use of private automobiles on our large highway network provides Americans with a high degree of personal mobility, continuing to allow people to travel where and with whom they want, but under conditions of increasing system unreliability and declining speeds. In 2001, 87 percent of daily trips involved the use of personal vehicles. Travel to and from work continues to decrease as a proportion of all travel, as trips rise for purposes including shopping, household errands, and recreational activities.

Highways are also a key conduit for freight movement in the United States. Trucks carried 60 percent of total freight shipments by weight and 70 percent by value (not including shipments moved by truck in combination with another mode). Trucks are playing an increasingly important role as businesses turn to just-in-time delivery systems to minimize logistics costs.

Transit plays a vital role in enhancing productivity and the quality of life in the United States. It provides basic mobility and expanded opportunities to people without the use of a car and broader transportation choices to people with cars. Transit plays a key role in economic growth and development, connecting workers and employers.

Transit helps people without cars take advantage of a wider range of job and educational opportunities and access health care and other vital services. It also enables them to be more active members of their communities and to build and maintain social relationships. In 2001, 43 percent of nationwide transit riders lived in households with incomes of less than 20,000 and 44 percent came from households without cars.

The Complementary Roles of Highways and Transit

Highways and transit are complementary, serving distinct but overlapping markets in the Nation's transportation system. A high-quality transit system gives people who prefer living in a dense, urban environment the opportunity to do so without sacrificing their mobility. An adequate highway network does the same for people who prefer a suburban or rural lifestyle.

Highway investments can benefit those transit modes that share roadways with private autos (such as buses, vanpools, and demand response vehicles). Having good highway access to transit stations in outlying areas increases the accessibility of transit.

Transit improvements can improve the operational performance of highways by attracting private vehicle drivers off the road during peak periods of congestion. The availability of a transit alternative as a backup mode can increase the attractiveness of carpooling for commuters.

The Evolving Federal Role

The Federal-aid highway program is a Federally assisted, State-administered program. Federal, State, and local transportation partners work together to deliver the Nation's highway program. In recent years, Congress has increased statutory authority for States to assume certain Federal-aid highway project oversight responsibilities, where appropriate, while the Federal Highway Administration has maintained responsibilities for program-level oversight, research, and deployment of new technologies and methods.

The Federal transit program is a Federally assisted and administered program, operated through a program of formula and discretionary grants to urban areas and, through States, to rural communities. Over time, the focus of the Federal government has shifted from formula to discretionary programs, such as the New Starts Program, which provides funds for the construction of new fixed guideway systems or extensions to existing systems. The Federal Transit Administration works with grantees to ensure that projects meet a range of criteria for both project justification and local financial commitment.

System Characteristics: Highways and Bridges

The mobility needs of the American people were served by a network of 4.0 million miles of public roads in 2004. About 75.1 percent of this mileage was located in rural areas (those with populations less than 5,000). While urban mileage constitutes only 24.9 percent of total mileage, these roads carried 64.1 percent of the 3.0 trillion vehicle miles traveled (VMT) in the United States in 2004. In 2004 there were 594,101 bridges over 6.1 meters (20 feet) in length; approximately 76.8 percent of these were in rural areas.

Rural local roads made up 51.3 percent of total mileage, but carried only 4.4 percent of total VMT. In contrast, urban Interstate highways made up only 0.4 percent of total mileage but carried 15.5 percent of total VMT.

Percentage of Highway Miles, Lane Miles, and Vehicle Miles Traveled by Functional System, 2004

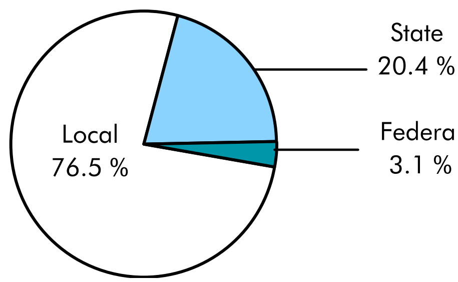
Functional System	Miles	Bridges	VMT
Rural Areas			
Interstate	0.8%	4.7%	9.0%
Other Principal Arterials	2.4%	6.1%	8.1%
Minor Arterial	3.4%	6.8%	5.7%
Major Collector	10.5%	15.8%	6.7%
Minor Collector	6.7%	8.3%	2.0%
Local	51.3%	35.1%	4.4%
Subtotal Rural	**75.1%**	**76.8%**	**35.9%**
Urban Areas			
Interstate	0.4%	4.7%	15.4%
Other Freeway & Expressway	0.3%	2.9%	7.0%
Other Principal Arterials	1.5%	4.1%	15.2%
Minor Arterial	2.5%	4.2%	12.3%
Collector	2.6%	2.6%	5.5%
Local	17.7%	4.7%	8.6%
Subtotal Urban	**24.9%**	**23.2%**	**64.1%**
Total	100.0%	100.0%	100.0%

Total highway mileage grew at an average annual rate of 0.2 percent between 1995 and 2004, while total VMT grew at an average annual rate of 2.5 percent. Rural road mileage has been declining since 1997, partly reflecting the reclassification of some Federal roads as nonpublic and the expansion of urban area boundaries as a result of the decennial Census.

Rural VMT grew at an average annual rate of 1.4 percent from 1995 to 2004, compared with an average annual increase of 1.8 percent in small urban areas (population 5,000 to 50,000) and 2.3 percent in urbanized areas. Rural VMT declined from 2002 to 2004 primarily as a result of boundary changes associated with the decennial Census; boundary changes also tend to inflate urban VMT growth.

In 2004, about 76.5 percent of highway miles were locally owned, States owned 20.4 percent, and 3.1 percent were owned by the Federal government.

Highway Mileage by Jurisdiction, 2004



In 2004, approximately 50.6 percent of bridges were locally owned, States owned 47.6 percent, 1.4 percent were owned by the Federal government, and 0.5 percent were either privately owned (including highway bridges owned by railroads) or had unknown or unclassified owners. Bridges are, on average, 40 years old with an average year of construction of 1964.

Based on surveys of 78 of the largest metropolitan areas, the deployment of intelligent transportation systems (ITS) has advanced steadily over time. Real-time data collection sensors have been deployed on more than one-third of the total freeway mileage in these areas, and on-call service patrols cover half of the freeway mileage.

Progress has also been made in the deployment of integrated ITS infrastructure. Among the 75 metropolitan areas tracked since 1997, the number with a "High" level of progress in the integrated deployment of ITS has risen from 11 to 30 in 2004, while the number of areas ranked "Low" has fallen from 39 to 12 (the remainder are ranked "Medium).

System Characteristics: Transit

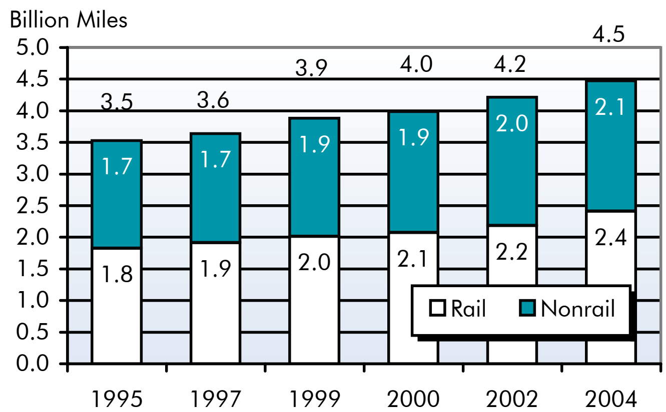
Transit system coverage, capacity, and use in the United States continued to increase between 2002 and 2004. In 2004, there were 640 transit operators serving urbanized areas, of which 600 were public agencies. A public transit provider may be a unit of a regional transportation agency, a State, a county, or a city government or it may be independent. In 2002, the most recent year for which information is available, there were 4,836 providers of special services to older adults and persons with disabilities receiving Federal Transit Administration (FTA) funds; and in 2000, the most recent year for which information is available, there were 1,215 transit operators serving rural areas.

In 2004, transit agencies in urban areas operated 120,659 vehicles (5 percent more than in 2002) of which 92,520 were in areas of more than 1 million people. Rail systems comprised 10,892 miles of track and 2,961 stations. There were 793 bus and rail maintenance facilities and 2,961 stations in urban areas, compared with 769 maintenance facilities and 2,862 stations in 2002. The most recent survey of rural operators in 2000 estimated that 19,185 transit vehicles operated in rural areas. The FTA estimates that in 2002 there were 37,720 special service transit vehicles for older adults and persons with disabilities, of which 16,219 were funded by FTA.

In 2004, transit systems operated 226,402 directional route miles, of which 216,620 were nonrail and 9,782 were rail route miles. Total route miles decreased by 3.8 percent between 2002 and 2004. Nonrail route miles decreased by 4.1 percent and rail route miles increased by 3.1 percent during this period.

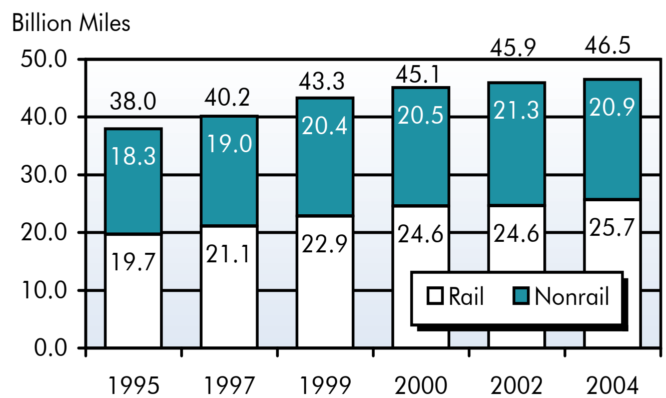
Transit revenue miles adjusted for capacity increased by 3.9 percent between 2002 and 2004. Rail capacity increased by 6.1 percent and nonrail capacity by 1.3 percent. Rail provided 2.4 billion capacity-equivalent miles in 2004, and nonrail provided 2.1 billion miles.

Urban Capacity-Equivalent Revenue Vehicle Miles (Billions)



Transit passenger miles traveled (PMT) increased by 1.3 percent between 2002 and 2004, from 45.9 billion to 46.5 billion. PMT traveled on nonrail modes decreased from 21.3 billion in 2002 to 20.9 billion in 2004, or by 2.1 percent. PMT on rail transit modes increased from 24.6 billion in 2002 to 25.7 billion in 2004, or by 4.3 percent.

Urban Passenger Transit Miles (Billions)



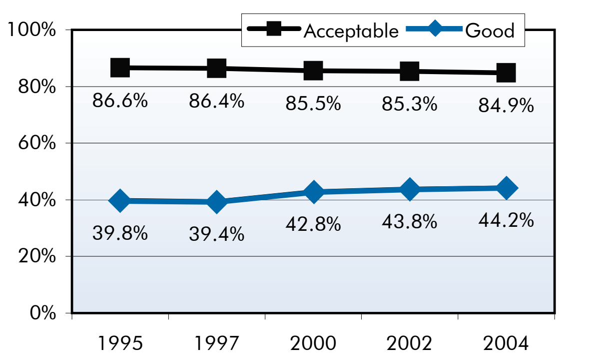
In 2004, 41 percent of PMT was on motorbus, 31 percent was on heavy rail, 21 percent was on commuter rail, and 3 percent was on light rail. The remaining modes accounted for 4 percent.

System Conditions: Highways and Bridges

Poor road surfaces impose costs on the traveling public in the form of increased wear and tear on vehicle suspensions and tires, delays associated with vehicles slowing to avoid potholes, and crashes resulting from unexpected changes in surface conditions. While highway agencies generally consider a variety of pavement distresses in assessing their overall condition, surface roughness most directly affects the ride quality experienced by drivers.

In 2004, 44.2 percent of travel on arterials and collectors for which data are available occurred on pavements with "good" ride quality, up from 39.8 percent in 1995. The percentage of VMT on roads with "acceptable" ride quality (a lower standard that includes roads classified as "good") fell from 86.6 percent to 84.9 percent over the same period of time.

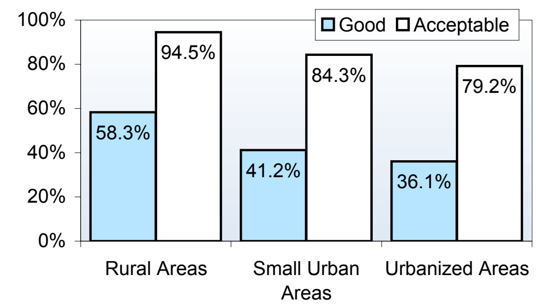
Percentage of VMT on Roads with Acceptable Ride Quality



Pavement ride quality is generally better on higher functional class roads and is better in rural areas than in urban areas. For example, approximately 97.8 percent of rural Interstate VMT in 2004 was on pavements with acceptable ride quality, compared with 72.4 percent for urbanized collectors.

In 2004, 58.3 percent of rural VMT occurred on roads with good ride quality, while 94.5 percent occurred on roads with acceptable ride quality. The comparable percentages for VMT in small urban areas were 41.2 percent good and 84.3 percent acceptable; for VMT in urbanized areas, 36.1 percent was on pavements with good ride quality, while 79.2 percent had acceptable ride quality.

Percentage of VMT on Roads with Acceptable Ride Quality, by Urban Area Size, 2004



Most bridges are inspected every 2 years and receive ratings based on the condition of various bridge components. Two terms used to summarize bridge deficiencies are "structurally deficient" and "functionally obsolete." Structural deficiencies are characterized by deteriorated conditions of significant bridge elements and reduced load-carrying capacity. Functional obsolescence is a function of the geometrics of the bridge not meeting current design standards. Neither type of deficiency indicates that a bridge is unsafe. Rural bridges tend to have a higher percentage of structural deficiencies, while urban bridges have a higher incidence of functional obsolescence due to rising traffic volumes. The percentage of bridges classified as deficient fell from 27.5 percent in 2002 to 26.7 percent in 2004. Most of this decline was the result of reductions in the percent of structurally deficient bridges.

Percentage of Rural and Urban Bridge Deficiencies, by Number of Bridges

Year		2002	2004
Rural Bridges	Structurally Deficient	15.1%	14.4%
	Functionally Obsolete	11.4%	11.0%
	Total Deficiencies	**26.5%**	**25.4%**
Urban Bridges	Structurally Deficient	9.2%	8.8%
	Functionally Obsolete	21.9%	21.6%
	Total Deficiencies	**31.2%**	**30.4%**
Total Bridges	Structurally Deficient	13.7%	13.1%
	Functionally Obsolete	13.8%	13.6%
	Total Deficiencies	**27.5%**	**26.7%**

System Conditions: Transit

The overall physical condition of the U.S. transit system can be evaluated by examining the age and condition of the various components of the Nation's infrastructure. This infrastructure includes vehicles in service, maintenance facilities, the equipment they contain, and other supporting infrastructure such as guideways, power systems, rail yards, stations, and structures (bridges and tunnels).

The Federal Transit Administration (FTA) has undertaken extensive engineering surveys and collected a considerable amount of data on the U.S. transit infrastructure to evaluate transit asset conditions. FTA uses a rating system of 1 "poor" to 5 "excellent" to describe asset conditions.

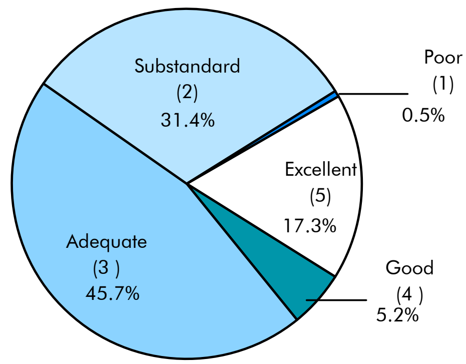
Definitions of Transit Asset Conditions

Rating	Condition	Description
Excellent	5	No visible defects, near new condition.
Good	4	Some slightly defective or deteriorated components.
Fair	3	Moderately defective or deteriorated components.
Marginal	2	Defective or deteriorated components in need of replacement.
Poor	1	Seriously damaged components in need of immediate repair.

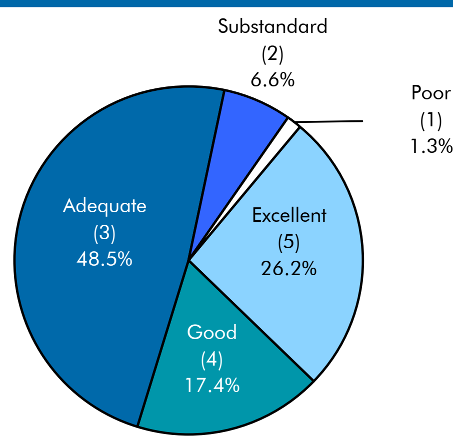
The average condition of urban bus vehicles has remained about the same, increasing from 3.07 in 2002 to 3.08 in 2004. The average age of urban bus vehicles decreased from 6.2 to 6.1 years. The average condition of bus maintenance facilities increased from 3.34 in 2002 to 3.41 in 2004. In 2004, 69 percent of bus maintenance facilities were in adequate or better condition, unchanged from 2002.

The average condition of rail vehicles increased from 3.47 in 2002 to 3.50 in 2004. The average age of rail vehicles declined from 20.4 years in 2002 to 19.7 in 2004. The condition of rail maintenance facilities increased from 3.56 in 2002 to 3.82 in 2004, primarily based on updated data collected directly from agencies. In 2004, 92 percent of rail maintenance facilities were estimated to be in adequate or better condition.

Conditions of Bus Maintenance Facilities 2004



Conditions of Rail Maintenance Facilities 2004



Source: Transit Economic Requirements Model.

The condition of rail stations increased from 2.87 in 2002 to 3.37 in 2004, based on new deterioration curves estimated from on-site surveys in 2004 and on updated data collected directly from transit agencies. Condition estimates in this report also reflect updated deterioration curves for signaling, traction power, and communications systems for rail systems developed from on-site surveys in 2005. In 2004, 100 percent of communications systems, 74 percent of train control systems, and 99 percent of traction power systems were in adequate or better condition. The conditions of elevated structures, underground tunnels, track, and rail vehicle storage yards improved between 2002 and 2004.

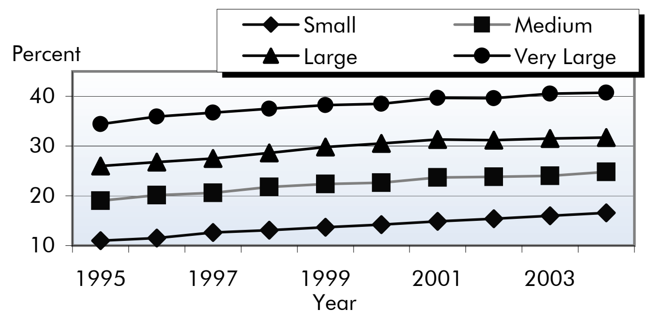
Operational Performance: Highways

Congestion on the Nation's highways imposes significant costs on drivers and society as a whole in the form of added travel time, vehicle operating costs, and emissions. Congestion results when traffic demand approaches or exceeds the available capacity of the highway system. It is clear that traffic demands vary significantly by time of day, day of the week, season of the year, and for special events. However, the available capacity at any given time is also variable, affected by weather, work zones, traffic incidents, and other nonrecurring events. Of the total congestion experienced by Americans, it is estimated that roughly half is "nonrecurring," associated with temporary disruptions in traffic demand and/or in available capacity.

There is no universally accepted definition or measurement of exactly what constitutes a congestion "problem," and this report uses a variety of different metrics to explore different aspects of congestion. The Texas Transportation Institute (TTI) has computed data for the FHWA for several measures, based on data for all 428 urbanized areas in 2004. (Note that the values shown for these same measures in TTI's 2005 *Urban Mobility Study* are different, since that study was based on a subset of 85 urbanized areas that is weighted more heavily to the most heavily populated areas.)

The Average Daily Percent of VMT under Congested Conditions is an indicator of the portion of daily traffic on freeways and other principal arterials in an urbanized area that moves at less than free-flow speeds. This percentage increased from 25.9 percent to 31.6 percent from 1995 to 2004 for the average urbanized area, and rose for each of four subsets based on population size reported by TTI; Small (population less than 500,000) rose from 15.4 percent to 16.6 percent, Medium (population 500,000 to 999,999) rose from 19.0 percent to 24.8 percent, Large (population 1 million to 3 million) rose from 26.0 percent to 31.7 percent, and Very Large (population greater than 3 million) rose from 34.4 percent to 40.7 percent. While the percent of VMT under congested conditions rose from 2002 to 2004, it rose at a lower rate than it had from 1995 to 2002.

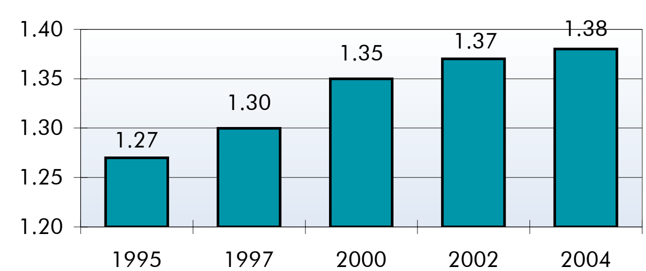
Percent of VMT Under Congested Conditions, by Urbanized Area Size, 1995–2004



The Average Length of Congested Conditions, a measure of the typical duration of congested travel conditions in urbanized areas, stabilized at approximately 6.6 hours per day in 2002 and 2004, after rising from 5.9 hours per day in 1995.

The Travel Time Index measures the amount of additional time required to make a trip during the congested peak travel period, rather than at other times of the day. The average travel time index for all urbanized areas for 2004 was 1.38, indicating that congestion caused travel times to be 38 percent longer. This is up slightly from the 1.37 value reported for 2002; the value for 1995 was 1.27.

Average Travel Time Index for All Urbanized Areas, 1995–2004



In 2004, the average delay experienced by the peak period travelers for all urbanized areas was 45.7 hours, up slightly from 45.4 hours in 2002. The average annual delay per capita (including all residents of a given area, not just peak travelers) rose from 23.8 hours in 2002 to 24.4 hours in 2004.

Operational Performance: Transit

Transit operational performance can be measured and evaluated on a number of different factors, including the speed of passenger travel, vehicle utilization, and service frequency.

Average operating speed in 2004 was higher than in 2002, and above its 10-year average. Average operating speed is an approximate measure of the speed experienced by transit riders and is affected by dwell times and the number of stops. In 2004, the average operating speed for all transit modes was 20.1 miles per hour, up from 19.9 in 2002, and above its 10-year average of 20.3. The average speed of nonrail modes was 14.0 miles per hour in 2004, up from 13.7 in miles per hour in 2002. The average speed for rail was 25.0 miles per hour in 2004, down from 25.3 in 2002.

Average vehicle utilization levels were lower in 2004 than in 2002 for all modes except demand response, ferryboat, and vanpool. Vehicle utilization is measured as passenger miles per vehicle operated in maximum service adjusted to reflect differences in the passenger-carrying capacities of transit vehicles. On average, rail vehicles operate at a higher level of utilization than nonrail vehicles. Commuter rail has consistently had the highest vehicle utilization rate, and demand response the lowest.

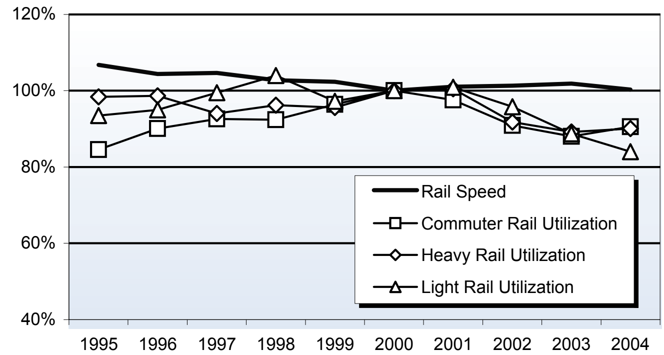
Vehicle Utilization Passenger Miles per Capacity-Equivalent Vehicle

(Thousands of Passenger Miles)

Mode	Utilization 2002	Utilization 2004
Commuter Rail	769	755
Heavy Rail	655	652
Vanpool	498	502
Light Rail	533	468
Motorbus	389	373
Ferryboat	297	328
Trolleybus	246	237
Demand Response	168	181

Changes in the capacity utilization of rail vehicles influence these vehicle operating speeds through changes in dwell times. As the capacity utilization of commuter rail, heavy rail, and light rail declined

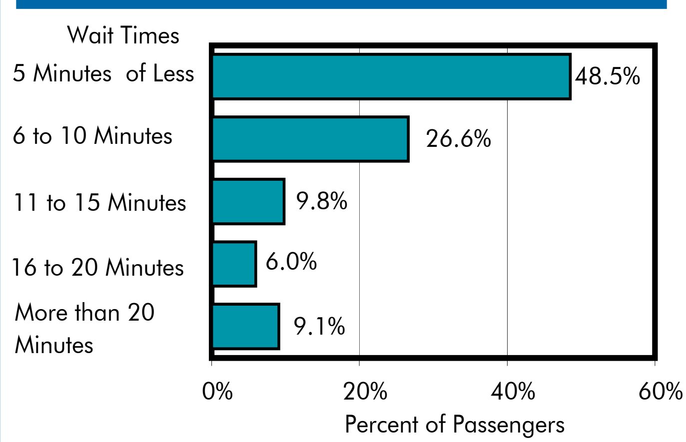
Index of Rail Speed and Capacity Utilization of Rail Vehicles (2000=100%)



from 2001 to 2003, average rail speed increased; and as the capacity utilization of heavy and commuter rail increased from 2003 to 2004, average rail speed decreased.

Most passengers who ride transit wait in areas that have frequent service. The 2001 National Household Travel Survey found that 49 percent of all passengers who ride transit wait for 5 minutes or less for a vehicle to arrive, and 75 percent wait 10 minutes or less. Nine percent of passengers wait for more than 20 minutes. To some extent, waiting times are correlated with incomes. Passengers with annual incomes above $65,000 are more likely to wait less time for a transit vehicle than passengers with incomes lower than $30,000. Higher-income passengers are more likely to be choice riders; passengers with lower incomes are more likely to use transit for basic mobility and to have more limited alternative means of travel.

Passengers by Waiting Times

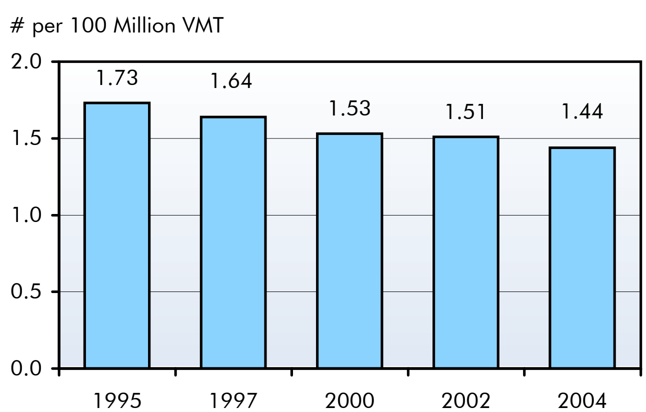


Safety Performance: Highways

Considerable progress has been made in reducing the number of highway fatalities since 1966, when Federal legislation first addressed highway safety. Since that time, the highest number of traffic deaths was 54,589 in 1972, while the lowest was 39,250 in 1992. Highway fatalities decreased from 43,005 in 2002 to 42,636 in 2004.

The fatality rate per 100 million VMT has declined over time, as the number of VMT has increased. In 1966, the fatality rate per 100 million VMT was 5.50; this figure had dropped to 1.73 in 1995, 1.51 in 2002, and 1.44 in 2004.

Fatality Rate, 1995–2004



Fatality rates are generally lower in urban areas than rural areas, and on higher-ordered functional systems than lower-ordered functional systems. For example, in 2004, the fatality rate per 100 million VMT on urban Interstate highways was 0.55, while the fatality rate on rural roads functionally classified as local was 3.08.

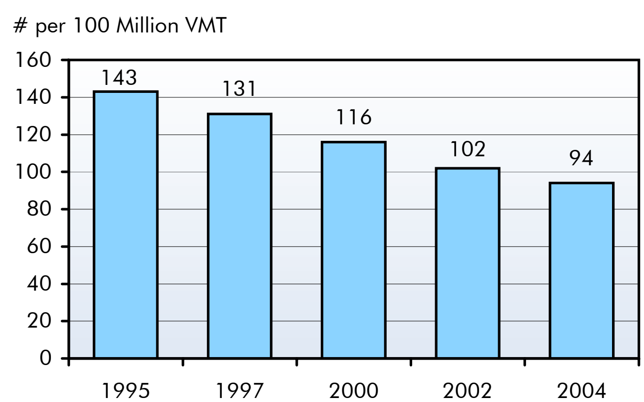
Of the 42,636 total fatalities in 2004, a reported 25,676 involved a roadway departure, in which a vehicle had left its lane. This includes 10,553 that involved a vehicle rollover, a 10.8 percent increase since 1997. The number of rollover fatalities among sport utility vehicles (SUVs) rose by 96.1 percent over that same time period.

About 9,117 highway fatalities occurred at intersections in 2004, down slightly from the 9,148 reported in 1995. Pedestrian fatalities have shown a steady decrease over time, dropping from 6,256 in 1995 to 5,494 in 2004.

Approximately 6.2 million crashes were reported in 2004. Only 0.6 percent of these crashes were severe enough to result in a fatality; 69.3 percent of these crashes resulted in property damage only, while 30.1 percent resulted in injuries.

The number of traffic-related injuries has declined over time, from 3.4 million in 1988, the first year for which statistics are available, down to 2.9 million in 2002 and 2.8 million in 2004. There were approximately 169 injuries per 100 million VMT in 1988; this figure declined to 143 in 1995, 102 in 2002, and 94 in 2004.

Injury Rate, 1995–2004



Alcohol-impaired driving is a serious public safety problem in the United States. Alcohol was a contributing factor in an estimated 16,694 fatalities in 2004 (39 percent of the total) and 7 percent of all crashes.

Speeding is one of the most prevalent factors contributing to traffic crashes. The estimated annual economic costs of speed-related crashes exceeded $40.4 billion in 2004. Speeding was a contributing factor in an estimated 13,192 fatalities in 2004 (31 percent of the total).

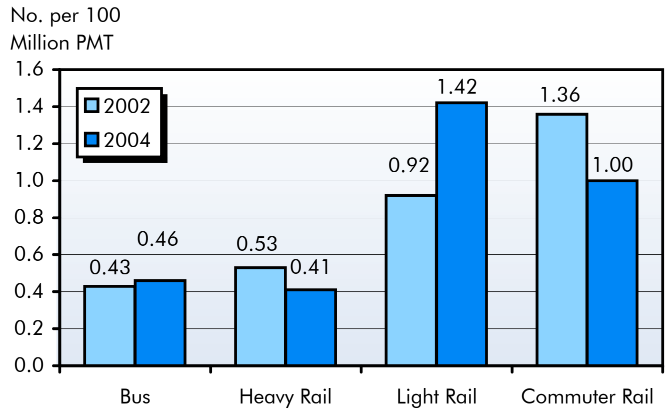
Safety Performance: Transit

Public transit in the United States has been and continues to be a highly safe mode of transportation, as evidenced by the statistics on incidents, injuries, and fatalities that have been reported by transit agencies for the vehicles they operate directly. Reportable safety incidents include collisions and any other type of occurrence that result in death, a reportable injury, or property damage in excess of a threshold. Injuries and fatalities include those suffered by riders as well as by pedestrians, bicyclists, and people in other vehicles. Reportable security incidents include a number of serious crimes (robberies, aggravated assaults, etc.), as well as arrests and citations for minor offenses (fare evasions, trepassings, other assaults, etc.). Injuries and fatalities may occur not just while traveling on a transit vehicle, but also while boarding, alighting, or waiting for a transit vehicle or as a result of a collision with a transit vehicle or on transit property.

In 2002, the definitions of an incident and an injury were revised. The threshold for a reportable safety incident was raised from $1,000 to $7,500. An injury was redefined to be an occurrence that required immediate transportation for medical care away from the scene of the incident. Before 2002, any event for which the FTA received a report was classified as an injury. These adjustments to incident and injury definitions led to a decrease in reported incidents and injuries in 2002. These adjustments preclude the direct comparison of incident and injury statistics with those for earlier years.

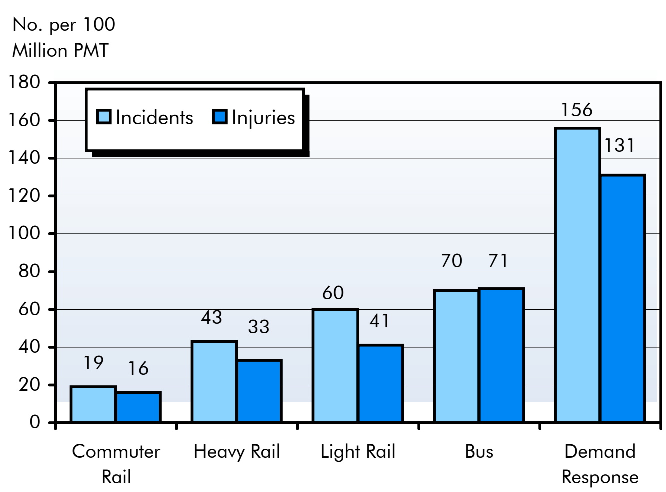
The definition of fatalities has remained the same. Fatalities decreased from 282 in 2002 to 248 in 2004, and fell from 0.66 per 100 million PMT in 2002 to 0.55 per 100 million PMT in 2004. Fatalities, adjusted for PMT, are lowest for motorbuses and heavy rail systems. Fatality rates for commuter and light rail have, on average, been higher than fatality rates for heavy rail. Commuter rail has frequent grade crossings with roads and shares track with freight rail vehicles; light rail is often at grade level and has minimal barriers between streets and sidewalks. There were no fatalities on demand response vehicles operated directly by public transit agencies in either 2002 or 2004.

Fatalities per 100 Million PMT, 2002 and 2004



Incidents (safety and security combined) and injuries per 100 million PMT declined for all modes combined from 2002 to 2004. Incidents and injuries, when adjusted for PMT, are consistently the lowest for commuter rail and highest for demand response systems.

Incidents and Injuries per 100 Million PMT, 2004

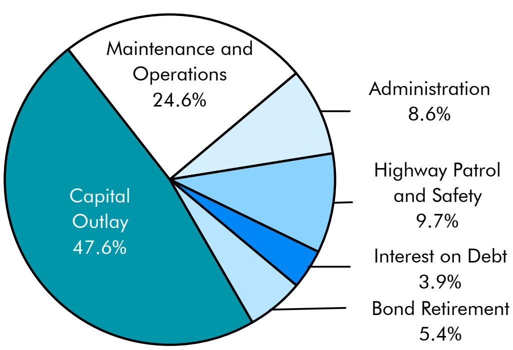


Finance: Highways

Taken together, all levels of government spent $147.5 billion for highways in 2004. Cash outlays by the Federal government for highway-related purposes were $33.1 billion (22.4 percent of the combined total for all levels), including both direct highway expenditures and amounts transferred to State and local governments for use on highways. States funded $72.9 billion (49.4 percent). Counties, cities, and other local government entities funded $41.5 billion (28.1 percent). **Private sector investment is playing an increasingly important role in highway finance**; this subject is discussed in Chapter 13.

Of the total $147.5 billion spent for highways in 2004, $70.3 billion (47.6 percent) was used for capital investments. Spending on maintenance and operations totaled $36.3 billion (24.6 percent); administrative costs (including planning and research) were $12.7 billion; $14.3 billion was spent on highway patrol functions and safety programs; $5.8 billion was used to pay interest; and $8.0 billion was used for bond retirement.

Highway Expenditures by Type, 2004

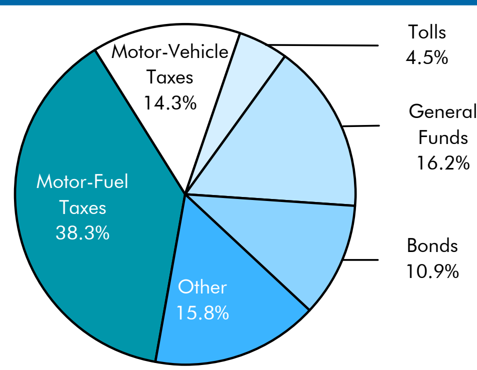


Total highway expenditures by all levels of government increased 44.7 percent between 1997 and 2004. Highway spending rose faster than inflation over this period, growing 22.7 percent in constant dollar terms. Capital spending grew by 45.2 percent between 1997 and 2002. Federal cash expenditures for capital purposes rose 52.9 percent, while State and local capital investment increased by 39.9 percent. As a result of Federal capital spending rising more quickly, the portion of total capital outlay funded by the Federal government rose from 41.6 percent in 1997 to 43.8 percent in 2004. The Federal percentage in 2002 was 46.1 percent, the highest level since 1986.

Of the $70.3 billion of capital spending by all levels of government in 2004, $36.4 billion (51.8 percent) was spent for system rehabilitation, the resurfacing, rehabilitation, and reconstruction of existing roadways and bridges. An estimated $14.7 billion (20.9 percent) was used to construct new roads and bridges; $12.8 billion (18.3 percent) went for adding new lanes to existing roads; and $6.4 billion (9.0 percent) went for system enhancements such as safety, operational, or environmental enhancements.

Highway-user revenues—the total amount generated from motor-fuel taxes, motor-vehicle fees, and tolls imposed by Federal, State, and local governments—were $105.8 billion in 2004. Of this, $83.0 billion (78.4 percent) was used for highways. This represented 57.1 percent of the total revenues generated by all levels of government in 2004 for use on highways. Other major sources of revenues for highways included bond proceeds of $15.8 billion (10.9 percent) and general fund appropriations of $23.6 billion (16.2 percent). Other sources such as property taxes, other taxes and fees, lottery proceeds, and interest income totaled $23.0 billion (15.8 percent).

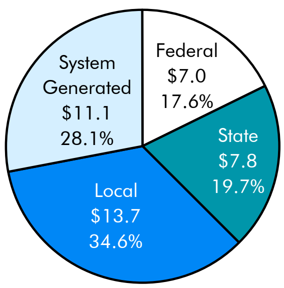
Revenue Sources for Highways, 2004



Finance: Transit

In 2004, $39.5 billion was available from all sources to finance transit capital investments and operations, compared with $36.5 billion in 2002. Transit funding comes from *public funds* allocated by Federal, State, and local governments and *system-generated revenues* earned by transit agencies from the provision of transit services. In 2004, Federal funds accounted for 18 percent of all transit revenue sources, State funds for 20 percent, local funds for 35 percent, and system-generated funds for 28 percent.

2004 Transit Revenue Sources (Billions of Dollars)

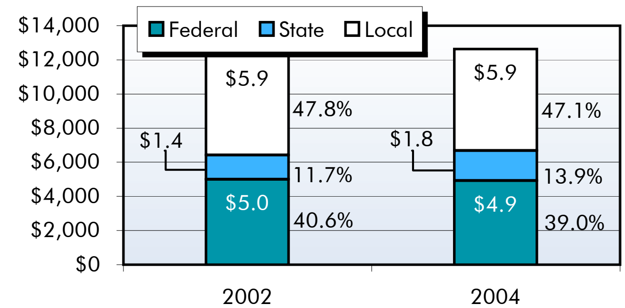


Eighty percent of the Federal funds allocated to transit are from a dedicated portion of the Federal motor-fuel tax receipts, and 20 percent are from general revenues. Federal funding for transit increased from $6.3 billion in 2002 to $7.0 billion in 2004, and State and local funding increased from $20.3 billion in 2002 to $21.5 billion in 2004.

In 2004, $12.6 billion, or 32 percent of total available transit funds, was spent on capital investment. Federal capital funding was $4.9 billion, or 39 percent of total capital expenditures; State capital funding was $1.8 billion, or 14 percent of total capital expenditures; and local capital funding was $5.9 billion, or 47 percent of total capital expenditures. Between 2002 and 2004, Federal capital funding decreased by 1.3 percent and State and local capital funding increased by 5.4 percent.

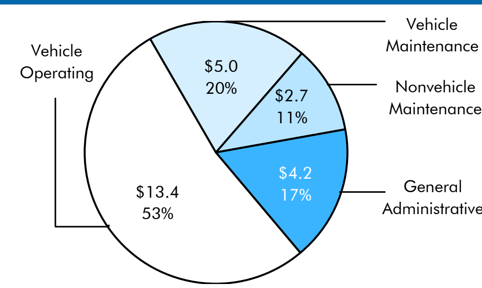
In 2004, $4.0 billion or 32 percent of total capital expenditures was for guideway; $3.4 billion or 27 percent of the total was for rolling stock, $2.1 billion or 16 percent of the total was for systems, and $1.1 billion or 9 percent of the total was for stations.

Sources of Transit Capital Investment Funding, 2002 and 2004 (Billions of Dollars)



In 2004, actual operating expenditures were $25.4 billion. Vehicle operating expenses were $13.4 billion, 53 percent of total operating expenses and 35 percent of total expenses; vehicle maintenance expenses were $5 billion, 20 percent of total operating expenses and 13 percent of total expenses; nonvehicle maintenance expenses were $2.7 billion, or 11 percent of total operating expenses and 7 percent of total expenses; and general administrative expenses were $4.2 billion, or 17 percent of total operating expenses and 11 percent of total expenses.

2004 Transit Operating Expenditures (Billions of Dollars)



In 2004, $26.9 billion was available for operating expenses, accounting for 68 percent of total available funds; the Federal government provided $2.0 billion or 8 percent of total operating expenses; State governments $6.0 billion or 22 percent of total operating expenses; local governments $7.9 billion or 29 percent of total operating expenses; and system-generated revenues $10.9 billion or 41 percent of total operating expenses.

Investment/Performance Analysis

Chapters 7 through 10 present and analyze estimates of 20-year capital investment scenarios for highways, bridges, and transit. The projections shown in this report reflect complex technical analyses that attempt to predict the impact that capital investment may have on the future conditions and performance of the transportation system. Separate estimates of investments for highways, bridges, and transit are generated independently by separate models and techniques. While the Highway Economic Requirements System (HERS), National Bridge Investment Analysis System (NBIAS), and Transit Economic Requirements Model (TERM) all utilize benefit-cost analysis, their methods for implementing this analysis are very different. Each model relies on separate databases, making use of the specific data available for only one part of the transportation system and addressing issues unique to each mode. **These three models have not yet evolved to the point where direct multimodal analysis would be possible**.

Chapter 7 presents estimates of future investment for specific scenarios, which are defined differently for each mode. These scenarios are intended to be illustrative only; **this report does not endorse any particular level of future highway, bridge, or transit investment.** While estimates are made of the cost to maintain future indicators of conditions and performance and current year levels, and the cost to improve performance based on standards unique to each model, these represent only two points on a continuum of alternative investment levels. Chapter 9 analyzes the impacts different levels of future investment might have on various measures of physical condition, operating performance, and system use.

Chapter 8 compares 2004 spending with the average annual investment scenario levels for the 2005–2024 period stated in constant 2004 dollars in Chapter 7 for the benchmark scenarios. The investment scenario estimates reflect the total capital investment required from **all sources**—Federal, State, local, and private—to achieve certain levels of performance. While the analyses in Chapter 8 identify the magnitude of the differences between current spending and the investment scenarios, they do not directly address which revenue sources might be used to finance additional investment, nor do they suggest how much might be contributed by each level of government. **This report makes no recommendations concerning future levels of Federal investment.**

As in any modeling process, simplifying assumptions have been made in HERS, NBIAS, and TERM to make analysis practical and to meet the limitations of available data. (See Appendices A, B, and C for more details on the individual models.) The accuracy of the projections of future investment scenarios depends in large part on the underlying assumptions used in the analysis. Chapter 10 explores the impact that varying some of these key assumptions would have on the overall results.

The HERS, NBIAS, and TERM models all have a broader focus than traditional engineering-based models, looking beyond transportation agency costs to consider the benefits that transportation provides to users of the system and some of the impacts that transportation investment has on nonusers. From an economic perspective, the cost of an investment in transportation infrastructure is simply the straightforward capital cost of implementing an improvement project. The benefits of transportation capital investments are generally characterized as the attendant reductions in costs faced by (1) transportation agencies (such as for maintenance), (2) users of the transportation system (such as savings in travel time and vehicle operating costs), and (3) others who are affected by the operation of the transportation system (such as reductions in environmental or other societal costs).

Investment/Performance Analysis

While the economic-based approach would suggest that projects be implemented in order based on their benefit-cost ratios (BCRs) until the funding available under a given scenario is exhausted, **in reality other factors influence Federal, State, and local decisionmaking** that may result in a different outcome. If some projects with lower BCRs were carried out in favor of projects with higher BCRs, then the actual amount of investment required to achieve any given level of performance would be higher than the amount predicted in this report. Consequently**, increasing spending to the level identified as the 'Cost to Maintain" would not guarantee that conditions and performance would actually be maintained**. Similarly, while the HERS, NBIAS, and TERM models all screen out potential improvements that are not cost-beneficial, simply increasing spending to the "Cost to Improve" level would not in itself guarantee that these funds would be expended in a cost-beneficial manner. Further, there may also be some projects that, regardless of economic merits, may be infeasible as a practical matter due to factors beyond those considered in the models. As a result, the supply of feasible cost-beneficial projects could be exhausted at a lower level of investment than is indicated by this scenario, and the projected improvements to future conditions and performance under this scenario may not be fully obtainable in practice.

This report has traditionally identified the amount of additional spending above current levels that would be required to achieve certain performance benchmarks, without considering the types of revenues required to support this additional spending. The implicit assumption has been that the financing mechanisms would not have any impact on the investment scenario estimates. In reality, however, increased funding from general revenue sources (such as property taxes, sales taxes, income taxes, etc.) would have different implications than increased funding from user charges (such as fuel taxes, tolls, and fares). For this report, the highway investment modeling procedures have been modified to assume that any increase in highway and bridge investment above 2004 levels would be funded entirely by increases in user charges, and a feedback loop has been added to account for the impact that this increase in the "price" of travel would have on deterring future travel and, by extension, reducing future investment scenario estimates.

While the assumption of increased levies on users via the current tax structure draws revenues, investment, and travel demand together, the inherent economic inefficiencies of the current structure would remain, whereby travel on uncongested facilities is charged at the same rate as those with significant congestion issues. In an ideal (from an economic point of view) world, users of congested facilities would be levied charges precisely corresponding to the economic cost of the delay they impose on one another, thereby reducing peak traffic volumes and increasing net benefits to all users combined.

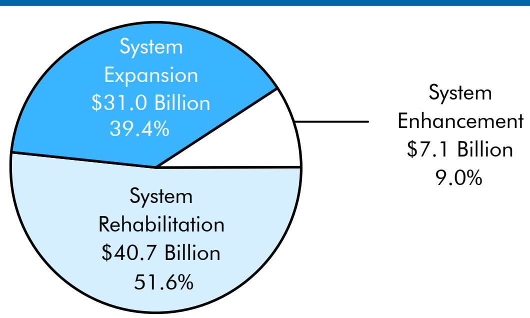
For this report, the HERS model has been adapted to illustrate the maximum, theoretical impact that efficient pricing could have on the estimates of future highway investment scenarios. This highly stylized analysis, presented in Chapter 10, assumes that congestion pricing would be implemented universally on all congested roads. **This analysis demonstrates that congestion pricing has considerable potential for reducing peak period congestion and future investment scenario estimates**. However, this analysis should be viewed as an interim product that will be refined in future editions of the C&P report. Importantly, it does not account for the considerable costs that could be associated with implementing and administering such a comprehensive pricing system. The methodology used for this analysis is presented in Appendix A. The "Pricing Effects" section in Part IV provides a further discussion of ongoing research in this area.

Capital Investment Scenarios: Highways and Bridges

Chapter 7 presents two illustrative future investment scenarios for highways and bridges. The Introduction to Part II (summarized on pages ES-12 and ES-13) includes critical background material required to properly interpret these scenarios. These scenarios assume the continuation of current highway financing mechanisms and current trends in the deployment of certain operations strategies and deployments; Chapter 10 explores the impacts of changing these and other key scenario assumptions.

The average annual **Cost to Maintain Highways and Bridges for the 20-year period 2005–2024 is estimated to be $78.8 billion**, stated in constant 2004 dollars. This scenario represents the level of investment **by all levels of government** required to (1) maintain the existing level of bridge deficiencies in constant dollar terms, and (2) keep the physical condition and operational performance of the highway system at a level sufficient to prevent average highway user costs (including travel time costs, vehicle operating costs, and crash costs) from rising above the existing level in constant dollar terms.

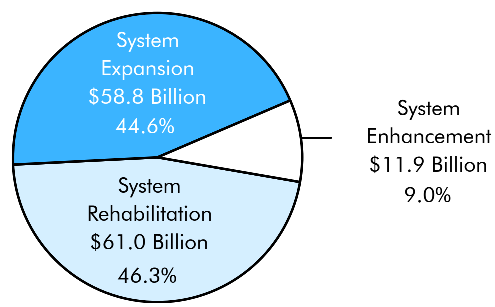
Cost to Maintain Highways and Bridges
Distribution by Improvement Type



Agency costs, such as maintenance, and societal costs, such as emissions, are considered in the benefit-cost analysis for future highway investments, but are not included in the calculation of the maintain user cost performance goal. Taxes are also excluded from the user cost target, since they are not a reflection of system conditions or performance. User taxes would rise under this scenario to cover the additional investment required above 2004 spending levels, so the total costs including taxes experienced by individuals under this scenario would increase.

The average annual **Maximum Economic Investment Level for Highways and Bridges for the 20-year period 2005–2024 is estimated to be $131.7 billion,** stated in constant 2004 dollars. This scenario represents the level of investment **by all levels of government** required to implement all cost-beneficial improvements on highways and bridges. This scenario can be viewed as an "investment ceiling" above which it would not be cost-beneficial to invest, even if unlimited funding were available.

Maximum Economic Investment
for Highways and Bridges
Distribution by Improvement Type



System rehabilitation improvements make up 51.6 percent of the Cost to Maintain and 46.3 percent of the Maximum Economic Investment level. This includes all capital investment aimed at preserving the existing highway and bridge infrastructure. System expansion improvements (adding capacity to the system through widening or other means) make up 39.4 percent of the Cost to Maintain and 44.6 percent of the Maximum Economic Investment level. The remaining 9.0 percent of each scenario is not directly modeled; this represents the current share of capital spending on system enhancements such as safety, traffic control facilities, and environmental enhancements.

Capital Investment Scenarios: Transit

Transit capital investment estimated under the "Maintain Conditions and Performance" scenario and estimated under the "Improve Conditions and Performance" scenario are 1.3 percent higher and 9 percent lower than in the 2004 report; the amount to improve performance has declined due to revisions in the benefit-cost analysis. Current investment estimates are for the period 2005–2024. The Maintain Conditions and Performance scenario projects the level of investment to maintain current average asset conditions over the 20-year period and to maintain current vehicle occupancy levels as transit passenger travel increases. The Improve Conditions and Performance scenario projects the level of invesment to raise the average condition of each major transit asset type to at least a level of "good," reduce average vehicle occupancy rates, and increase average vehicle speeds. The Improve Conditions and Performance scenario defines an upper limit above which additional investment in transit is unlikely to be economically justifiable.

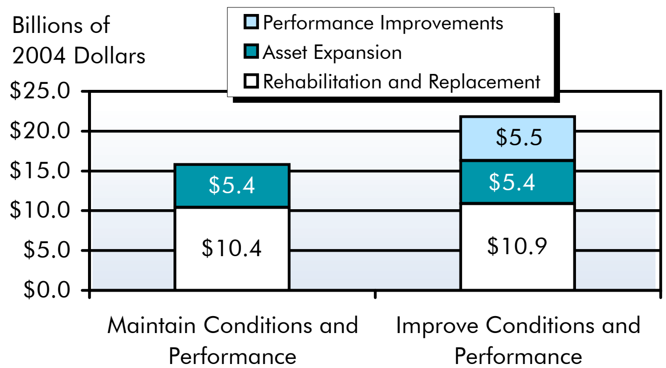
Transit Average Annual Investment Scenario Estimates, 2003–2022 and 2005–2024

(Billions of Dollars)

	Average Annual Cost	
	2003–2022	2005–2024
Conditions & Performance	2002 Dollars	2004 Dollars
Maintain	$15.6	$15.8
Improve	$24.0	$21.8

Average annual investment is estimated to be $15.8 billion to maintain conditions and performance ($15.6 billion in 2002) and $21.8 billion to improve conditions and performance ($24.0 billion in 2002). Under the "Maintain" scenario, $10.4 billion annually would be needed for asset rehabilitation and replacement and $5.4 billion for asset expansion. Under the "Improve" scenario, $10.9 billion would be needed annually for replacement and rehabilitation, $5.4 billion for asset expansion, and $5.5 billion for performance improvements. Eighty-seven percent of the investment under the "Maintain" scenario, or $13.8 billion, would be required in urban areas with populations of over 1 million, reflecting the fact that in 2004, 92 percent of the Nation's passenger miles were in these areas.

Annual Cost to Maintain and Improve Conditions and Performance by Investment Type, 2005–2024



Of the investment required to maintain conditions and performance, vehicles account for 45 percent ($7.1 billion annually), guideway elements for 18 percent ($2.9 billion), facilities for 12 percent ($1.9 billion), stations for 9 percent ($1.4 billion), systems for 9 percent ($1.4 billion) and other project costs for 6 percent ($1.0 billion). Of the investment under the Improve Conditions and Performance scenario, vehicles account for 42 percent ($9.2 billion annually), guideway elements for 19 percent ($4.2 billion), facilities for 11 percent ($2.4 billion), stations for 10 percent ($2.1 billion), systems for 7 percent ($1.6 billion) and other project costs for 11 percent ($2.3 billion).

Average Annual Transit Investment Scenario Estimates by Asset Type, 2005–2024

(Billions of 2004 Dollars)

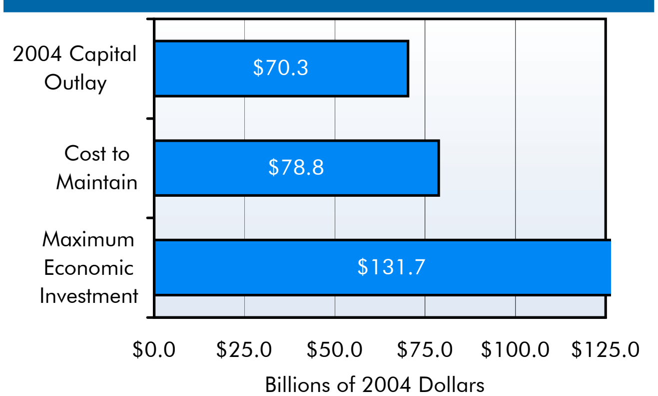
	Maintain	Improve
Vehicles	$7.1	$9.2
Guideway Elements	$2.9	$4.2
Facilities	$1.9	$2.4
Stations	$1.4	$2.1
Systems	$1.4	$1.6
Other Project Costs	$1.0	$2.3

Comparison of Spending and Investment Scenario Estimates: Highway and Bridge

Chapter 8 compares the investment estimates for the two illustrative scenarios introduced in Chapter 7 with current and projected spending levels. **This report does not endorse either of these two scenarios as a target level of funding**, nor does it make any recommendations concerning future levels of Federal funding.

Federal, State, and local capital expenditures for highways and bridges totaled $70.3 billion in 2004. **Capital outlay by all levels of government would have to increase by 12.2 percent above this level to reach the $78.8 billion Cost to Maintain Highways and Bridges level.** The percentage gap for highway resurfacing and reconstruction (part of the system rehabilitation component of the Cost to Maintain) is larger, at approximately 23.0 percent. In contrast, capital expenditures for bridge rehabilitation and replacement (also part of system rehabilitation) were 16.6 percent higher than the estimated annual cost to maintain the current economic backlog of bridge improvements in constant dollar terms. This is consistent with the reduction in the number of deficient bridges observed in recent years.

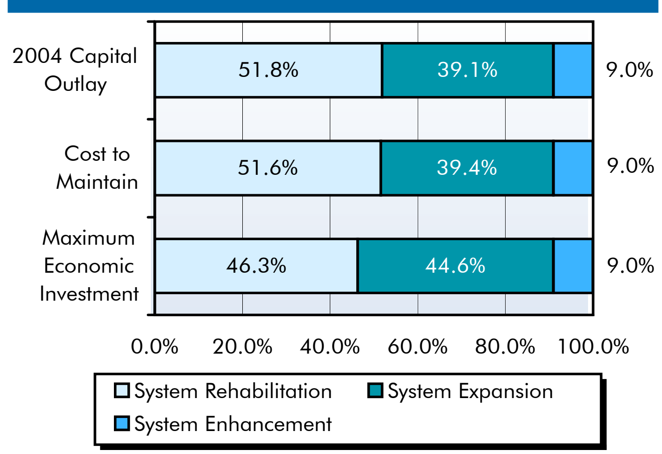
2004 Capital Outlay by All Levels of Government vs. Highway and Bridge Investment Scenario Estimates



An increase in capital outlay of 87.4 percent above current levels would be required to reach the projected $131.7 billion Maximum Economic Investment level for highways and bridges.

The distribution of funding by investment type suggested by the investment scenarios developed using the HERS and NBIAS models depends on the level of funding. In 2004, 39.1 percent of highway capital outlay went for system expansion, including the construction of new roads and bridges and the widening of existing facilities. This is very close to the percentage suggested by the "Cost to Maintain" scenario to be used for capacity expansion investments (39.4 percent). However, if funding levels were to rise significantly above this level, the analysis identifies a number of cost-beneficial potential investments to combat highway congestion, so that at the Maximum Economic Investment level, 44.6 percent of total investments are for capacity expansion.

Investment Scenarios and 2004 Capital Outlay Distribution by Improvement Type



The estimated gaps between current spending and the two investment scenarios are higher than the estimates shown in the 2004 edition of this report, which compared 2002 highway capital outlay with investment scenarios for 2003 to 2022. The estimated Cost to Maintain in that report was 8.3 percent higher than 2002 spending, and the gap between 2002 spending and the Maximum Economic Investment level was 74.3 percent.

Comparison of Spending and Investment Scenario Estimates: Transit

Transit capital expenditures from Federal, State, and local governments totaled $12.6 billion in 2004, below the annual investment amounts estimated by the TERM scenarios for the 20-year period from 2005–2024. **The annual capital investment estimated by the Maintain Conditions and Performance scenario is $15.8 billion, 25 percent above actual spending in 2004.** The investment estimated by the Improve Conditions and Performance scenario is $21.8 billion, 73 percent above actual 2004 capital spending.

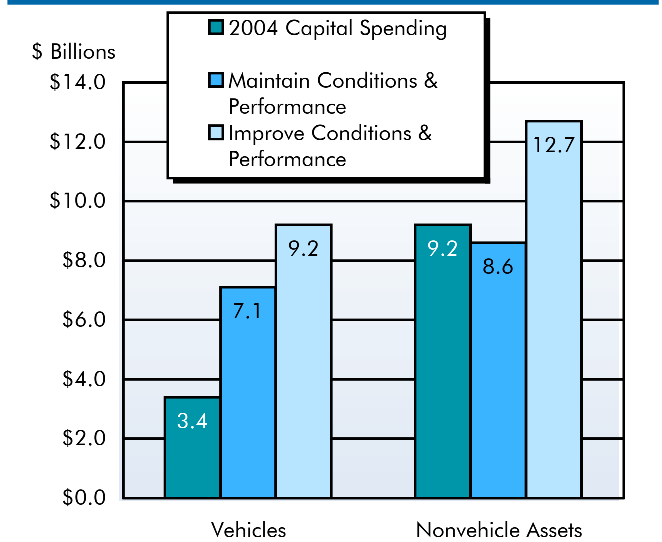
The gap between actual vehicle capital investment and the amount to maintain and improve the conditions of vehicle assets has widened since the last report and the gap between actual nonvehicle asset investment and the amount to maintain and improve the conditions of nonvehicle assets has declined, in part, due to a decrease in the share of capital spending on vehicles from 31 percent in 2002 to 27 percent in 2004, and an increase in the share of capital spending on nonvehicles from 69 to 73 percent.

The estimated average annual amount to maintain the conditions and performance of the Nation's transit vehicle assets of $7.1 billion is 109 percent above actual spending of $3.4 billion in 2002. The estimated average annual amount to improve conditions and performance of transit vehicles is $9.2 billion, 171 percent above the 2004 investment.

The average annual amount to maintain the conditions and performance of the Nation's nonvehicle transit infrastructure of $8.6 billion is 7 percent below the $9.2 billion spent in 2004. The average annual amount to improve the conditions and performance of the nonvehicle infrastructure is $12.7 billion, 38 percent above actual spending in 2004.

In addition to continually replacing existing transit assets, the annual investment scenarios estimates include the expansion of existing assets to meet projected demand and improve operational performance. To maintain performance, TERM estimates that an additional 26,000 buses and 5,500 rail vehicles would need to be purchased between 2005 and 2024 to meet a projected ridership growth of 1.57 percent. This would be roughly a 24 percent increase in the 2004 bus fleet size, and a 21 percent increase in the 2004 rail fleet size. To improve performance, TERM estimates that an additional 3,000 rail vehicles would be needed, or about a 12 percent increase in the 2004 rail fleet size.

A Comparison of 2004 Capital Spending with Average Annual Investment Scenario Estimates (Billions of Dollars)



The gap between the annual investment estimated by the Maintain Conditions and Performance scenario and actual investment is similar to what was reported in the 2004 edition. The gap between the annual investment estimated by the Improve Conditions and Performance scenario and actual investment is about 20 percent lower than reported in the 2004 report due to a decrease in the estimate required to improve conditions and performance. This decline was primarily due to a decrease in investment needed to improve performance resulting from a reduction in the assumed hourly cost of congestion delay.

Impacts of Investment: Highways and Bridges

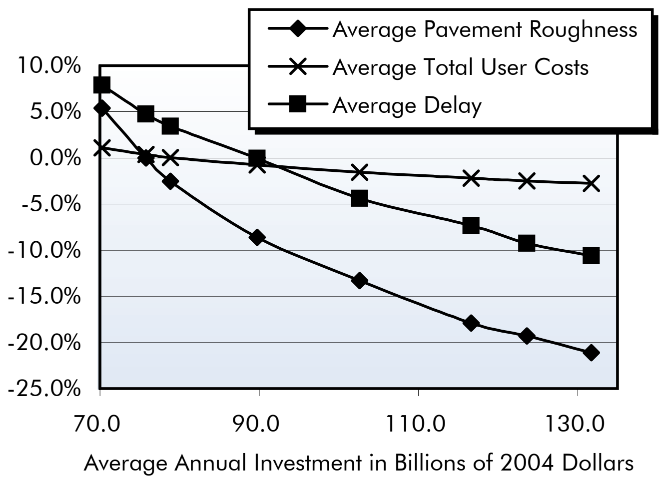
Spending by all levels of government on system rehabilitation rose by 58.0 percent between 1997 and 2004, from $23.0 billion to $36.4 billion. This increased investment in roadway resurfacing and reconstruction and bridge rehabilitation and replacement is reflected in the increases in the percent of VMT occurring on pavements with good ride quality and the decreases in bridge deficiencies that are described in Chapter 3.

Investment in system expansion has also increased from 1997 to 2004, but at a much lower rate relative to outlays for system preservation. While the rate of deterioration in various measures of operational performance has decreased, the level of investment has not stopped the overall growth in congestion levels that is described in Chapter 4.

If annual highway capital investment from 2005 to 2024 averages the $131.7 billion (in constant 2004 dollars) level specified by the "Maximum Economic Investment" scenario, and is applied in the manner suggested (devoting a larger share of investment toward capacity expansion to address congestion problems), then average highway user costs would be expected to decline by 2.8 percent per VMT in constant dollar terms. While this percentage appears relatively low, by the year 2024 it would translate into approximately $116 billion in annual user cost savings. (There is a practical limit on the ability of highway investments to cause dramatic reductions in total user costs, since they include the time costs associated with getting from point A to point B in uncongested conditions). Average delay per VMT would decline by 10.6 percent under the "Maximum Economic Investment" scenario. (Delay due to incidents would decline much more sharply, as the level of future investments in operations and intelligent transportation systems assumed in these scenarios would have a greater effect on nonrecurring delay.) Average pavement ride quality would be expected to improve by 21.1 percent relative to 2004 levels.

If all levels of government combined invested at the projected Cost to Maintain level of $78.8 billion, average highway user costs in 2024 would by definition match those in 2004. Average pavement ride quality would improve by 2.5 percent, while delay per VMT would worsen by 3.4 percent.

Projected Changes in 2024 Highway Condition and Performance Measures Compared with 2004 Levels, at Different Possible Funding Levels



The amount of travel growth on a highway segment may be affected by the level of investment on that segment. Investments that reduce the economic cost of using the facility will tend to encourage additional use, while increasing congestion on an unimproved roadway can cause travel growth to be lower than it otherwise would be. The travel growth forecasts used in the analysis of highway investment in this report are dynamic, in the sense that they allow feedback between the level of future investment and future VMT growth.

Relative to previous editions, the difference between the projected average annual VMT growth rate in the two scenarios is narrower (1.94 percent versus 1.88 percent), due to the imposition of user charges to cover the increased spending associated with each scenario.

Impacts of Investment: Transit

Funding levels between 2002 and 2004 have been sufficient to maintain conditions. The investment estimated by the "Maintain Conditions" scenario assumes that an average condition of 3.6 will be reached in 2024, compared with an average condition of 3.9 in 2004. To reach an average condition of 3.9 in 2024 would require the maintain conditions investment estimate to include replacement expenditures for some assets not needing replacement over the 2003 to 2024 period.

If the amount spent on capital investment is 10 percent lower than the amount estimated to be needed to maintain conditions in urban areas ($8.89 billion annually instead of $9.88 billion annually), the average condition of transit assets is estimated to fall from 3.6 in 2004 to 3.5 in 2024. If this amount is lowered by 30 percent to $6.92 billion annually, average asset conditions are estimated to fall to 3.4 in 2024.

Effect of Capital Spending Constraints on Transit Conditions

	2004 Condition	Percent of Recommended Rehabilitation and Replacement Expenditures to Maintain Conditions			
Asset Type		**100%**	**90%**	**80%**	**70%**
Guideway Elements	4.4	4.1	4.0	4.0	3.9
Facilities	3.6	3.2	2.9	2.9	2.9
Systems	3.9	3.7	3.7	3.5	3.4
Stations	3.4	3.1	3.1	3.1	3.1
Vehicles	3.4	3.4	3.3	3.3	3.1
All Assets	**3.9**	**3.6**	**3.5**	**3.5**	**3.4**
Replacement Expenditure Scenarios [1]		$9.88	$8.89	$7.91	$6.92

[1] Excludes rural vehicles and facilities.

Funding levels between 2002 and 2004 have also been sufficient to maintain performance as measured by passenger travel time and vehicle occupancy. TERM estimates that for urban areas $5.2 billion annually will be needed to maintain current performance if PMT increases annually at the projected rate of 1.57 percent, or about 850 million new passengers per year.

TERM considers, in its benefit-cost analysis, the effect of capital investment on transit user costs and the effect of change in these costs on transit ridership. Transit user costs are composed of two components: the out-of-pocket transit fare cost and the time spent making the trip or "travel-time cost." Travel-time savings are realized by adding or expanding an existing rail or BRT service or by adding vehicles to reduce crowding. Out-of-pocket savings occur when passengers switch from automobiles to transit.

TERM estimates that $5.2 billion annually is required to improve transit performance in urban areas, $2.01 billion annually for asset expansion in new rail or BRT service to increase speed, and $3.16 billion annually for asset expansion in new vehicles to reduce occupancy levels. The average ridership estimated to result from increasing speed is 22.9 million passengers annually; the average annual ridership estimated to result from decreasing occupancy levels is 51.6 million passengers annually.

Sensitivity Analysis: Highways and Bridges

The usefulness of any investment scenario analysis depends on the validity of the underlying assumptions used to develop the analysis. Since there may be a range of appropriate values for several of the model parameters used in these analyses, this report includes an analysis of the sensitivity of the baseline analyses presented in Chapter 7 to changes in these assumptions.

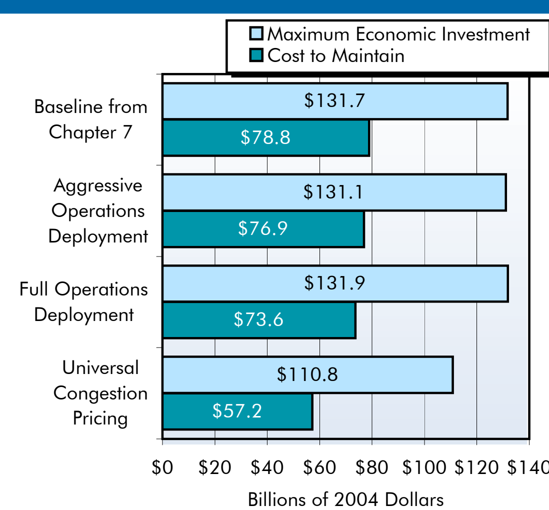
While previous editions of the C&P report have examined the effects of a 25 percent constant dollar increase in highway construction costs, this alternative analysis has taken on additional significance due to recent spikes in the costs of various construction materials and petroleum products. Such an increase would lead to a comparable increase in the average annual Cost to Maintain highways and bridges; the Maximum Economic Investment level would rise by only 11.2 percent, as some potential improvements would no longer be cost-beneficial.

This edition of the report also includes theoretical scenarios involving alternative congestion reduction strategies. The baseline scenarios in Chapter 7 reflect the effects of selected operations strategies and intelligent transportation systems (ITS), assuming existing deployment trends continue. However, if the deployment rates were to accelerate significantly, the Cost to Maintain could decline by 2.4 percent. Assuming full immediate deployment in all applicable locations would bring down the Cost to Maintain by 6.6 percent. The Maximum Economic Investment level would not change significantly, as many of these operations deployments would complement, rather than substitute for, other cost-beneficial highway investments. However, under these alternative assumptions, projected future operational performance would be significantly improved; highway users would save an extra $10 billion annually by 2024 in terms of reduced delay and other costs assuming aggressive deployment rates; assuming full immediate deployment, these savings would rise to $27 billion per year by 2024.

The baseline scenarios in Chapter 7 also assume the continuation of existing financing structures, with their inherent economic inefficiencies. In an ideal (from an economic point of view) world, users of congested facilities would be levied charges precisely corresponding to the economic cost of the delay they impose on one another, thereby reducing peak traffic volumes and increasing net benefits to all users combined. **A preliminary analysis of universal congestion pricing using the HERS model suggests that such a strategy could significantly reduce the level of future highway investment that would be required to maintain or improve highway operational performance.**

Applying congestion tolls along the principles outlined above to all congested roads could reduce the Cost to Maintain by $21.6 billion per year (27.5 percent), leaving it well below the $70.3 billion level of capital spending in 2004. The Maximum Economic Investment level would be reduced by $20.9 billion (15.9 percent) even while generating a better level of system performance than the baseline scenario. Note that this analysis does not reflect the startup or administrative costs that would be associated with implementing a pricing strategy of this nature. This analysis will be refined in future editions of the C&P report, which might increase or decrease these estimated impacts.

Impact of Congestion Reduction Strategies on Average Annual Investment Scenario Estimates



Sensitivity Analysis: Transit

Chapter 10 examines the sensitivity of projected transit investment to variations in the values of exogenously determined model inputs including passenger miles traveled (PMT), capital costs, the value of time, and user cost elasticities.

Sensitivity to Changes in Passenger Miles Traveled

The Transit Economic Requirements Model (TERM) relies on forecasts of PMT in large urbanized areas to determine estimates of projected investment in the Nation's transit systems for the "Maintain Performance" scenario (i.e., current levels of passenger travel speeds and vehicle utilization rates) as ridership increases and the "Improve Performance" scenario (i.e., increase passenger travel speeds and reduce crowding).

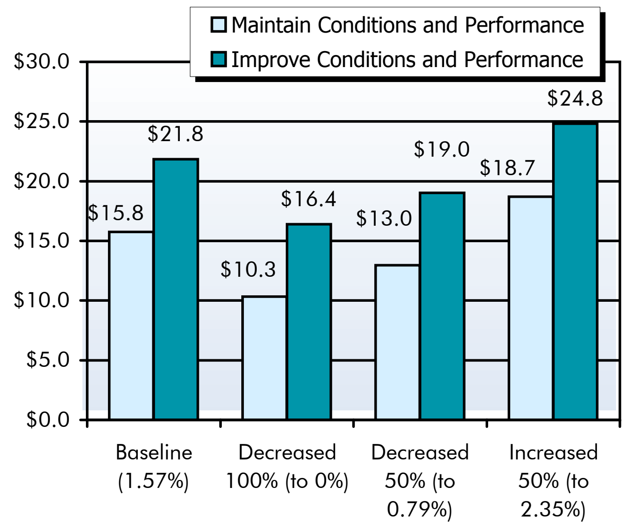
PMT forecasts are generally made by metropolitan planning organizations (MPOs) in conjunction with projections of vehicle miles traveled (VMT). The average annual growth rate in PMT of 1.57 percent used in this report is a weighted average of the most recent MPO forecasts available from 92 of the Nation's largest metropolitan areas. Transit investment estimates in the 2004 report were based on a projected PMT growth rate of 1.5 percent, based on projections from 76 MPOs. (PMT increased at an average annual rate of 2.29 percent between 1995 and 2004 and by 0.65 percent between 2002 and 2004.)

Varying the assumed rate of growth in PMT affects estimated transit investment both for the "Maintain" and "Improve" scenarios. A 50 percent increase/decrease in growth will increase/decrease the cost to maintain conditions and performance by 18 to 19 percent and the cost to improve conditions and performance by 13 to 14 percent. Investment estimated by both the "Maintain" and "Improve" scenarios would decrease significantly if PMT was assumed to remain constant.

Sensitivity to a 25 Percent Increase in Capital Costs

Given the uncertainty of capital costs, a sensitivity analysis was performed to examine the effect

The Effect of Variations in PMT Growth on Transit Annual Investment Scenario Estimates (Billions of 2004 Dollars)



of higher capital costs on the projected transit investment. A 25 percent increase in capital costs increases the investment estimated by the Maintain Conditions and Performance scenario by 18 percent and increases the investment estimated by the Improve Conditions and Performance scenario by 15 percent.

Sensitivity to Changes in the Value of Time

The value of time is used to determine the total benefits accruing to transit users from transit investments that reduce passenger travel time. Variations in the value of time were found to have a limited effect on the investment estimates, since changes in the value of time have inverse effects on the demand for transit services.

Sensitivity to Changes in the User Cost Elasticities

TERM uses user cost elasticities to estimate the changes in ridership that will result from changes in fare and travel time costs, resulting from infrastructure investment to increase speeds, decrease vehicle occupancy levels, and increase frequency. A doubling or halving of these elasticities was found to have almost no effect on projected investment.

CHAPTER 11: *Executive Summary*

Interstate System

In 2006, the Dwight D. Eisenhower National System of Interstate and Defense Highways, commonly known as the Interstate System, turned 50 years old. The 46,747 miles of Interstate highways serve as the backbone of transportation and commerce in the United States. About 67.1 percent of this 2004 mileage was in rural areas, 4.5 percent was in small urban areas, and 28.3 percent was in urbanized areas. In 2004, Americans traveled approximately 267 billion vehicle miles on rural Interstates, 26 billion on small urban Interstates, and 434 billion on urbanized Interstates. Taken together, this represents approximately 24.5 percent of all U.S. travel in 2004.

The Interstate System is growing more crowded; Interstate VMT grew at an average annual rate of 2.8 percent from 1995 to 2004, outpacing the 0.5 percent average annual growth in lane miles over that period. On rural Interstates, 73.7 percent of VMT in 2004 was on pavements with good ride quality; comparable figures for small urban and urbanized Interstates were 65.6 percent and 48.5 percent, respectively. Current spending on rural Interstate highways appears adequate to further improve pavement ride quality and reduce overall highway user costs, if sustained in constant dollar terms. On urban Interstates, significant increases in funding for rehabilitation and expansion would be required to prevent both average physical conditions and operational performance from becoming degraded.

The Interstate System included 55,315 bridges in 2004, 27,648 in rural areas and 27,667 in urban areas. In 2004, about 15.9 percent of rural Interstate bridges were considered to be deficient, including 4.2 percent classified as structurally deficient and 11.7 percent classified as functionally obsolete. Among urban Interstate bridges, about 26.5 percent were considered to be deficient in 2004, including 5.1 percent classified as structurally deficient and 20.5 percent classified as functionally obsolete.

CHAPTER 12: *Executive Summary*

National Highway System

The National Highway System (NHS) has five components, including (1) the Interstate System, (2) selected other principal arterials deemed most important for commerce and trade, (3) the Strategic Highway Network (STRAHNET), (4) STRAHNET connectors, and (5) intermodal connectors that provide access between major intermodal passenger and freight facilities and other NHS components. The NHS includes 87.5 percent of urban other freeways and expressways, 35.9 percent of urban other principal arterials, and 83.8 percent of rural other principal arterials. While the NHS makes up only 4.1 percent of total U.S. mileage, it carries 44.8 percent of total travel.

In 2004, 68.0 percent of rural NHS travel was on pavements with good ride quality, compared with 42.5 percent of urban NHS travel. Approximately 97 percent of rural NHS travel was on pavements with acceptable ride quality, compared with 86.9 percent of urban NHS travel.

In 2004, 19.4 percent of all U.S. bridges were located on the NHS, but these bridges had 49.5 percent of the total deck area on all bridges and carried 71.1 percent of the traffic on all bridges. Approximately 20.5 percent of NHS bridges were considered deficient in 2004, including 5.6 percent classified as structurally deficient and 14.9 percent classified as functionally obsolete.

In 2004, all levels of government spent a combined $34.6 billion for capital improvements to the NHS, which was 49.2 percent of total capital expenditures on all roads. If current spending for NHS bridge rehabilitation and replacement were sustained in constant dollar terms over 20 years, the current backlog of deficient bridges could be reduced, but not eliminated. If current spending levels on the urban NHS for system expansion plus pavement resurfacing and reconstruction were sustained, urban pavement condition and operational performance would be expected to decline. Current spending on the rural NHS is adequate to improve rural conditions and performance.

Innovative Finance

While the traditional financing mechanisms discussed in Chapter 6 provide most of the funding that supports surface transportation, innovative financing mechanisms are playing an increasingly important role. This report defines "Innovative Finance" broadly, reflecting a wide array of techniques designed to supplement traditional financing mechanisms, including credit assistance, innovative debt financing and public-private partnerships.

The **Transportation Infrastructure and Finance Innovation Act** (TIFIA) program is administered by the DOT and offers eligible applicants the opportunity to compete for secured (direct) loans, loan guarantees, and standby lines of credit for up to one-third of the cost of construction for nationally and regionally significant projects, provided that the borrower has an associated revenue stream, such as tolls or local sales taxes, that can be used to repay the debt issued for the project. Since the program's inception in 1999 through July of 2006, TIFIA has provided almost $3.2 billion in credit assistance to projects representing more than $13.2 billion in infrastructure investment.

The **State Infrastructure Bank (SIB) Pilot Program** provides increased financial flexibility for infrastructure projects by offering direct loans and loan guarantees. SIBs are capitalized with Federal and State funds. Each SIB operates as a revolving fund and can finance a wide variety of surface transportation projects. As loans are repaid, additional funds become available to new loan applicants. As of June 2005, $5.1 billion in loan agreements had been made by 33 States, of which $3.7 billion had been disbursed for 457 loan agreements. SIB loans are being used to fund both highway and transit projects; 21 States have signed SIB cooperative agreements with the FTA and eight have executed at least one public transit loan. SIB transit loans of $94.5 million are assisting $318.7 million in transit projects.

States are increasingly looking to the private sector as another potential source of highway and transit funding, either in addition to or in concert with new credit and financing tools. The private sector often has expertise that may not be readily available in the public sector that can bring innovation and efficiency to many projects.

A variety of institutional models are being used including (1) concessions for the long-term operation and maintenance of individual facilities or entire highway systems; (2) purely private sector highway design, construction, financing, and operation; and (3) **Public-Private Partnerships (PPPs)** in designing, constructing, and operating major new highway systems.

Options for PPPs stretch across a spectrum of increased private responsibilities and range from transferring tasks normally done in-house to the private sector, to combining typically separate services into a single procurement or having private sector partners assume owner-like roles.

SAFETEA-LU amended the Internal Revenue Code to include highway facilities and surface freight transfer facilities among the types of privately developed and operated projects that can utilize tax-exempt **private activity bond** financing.

The FHWA has a number of initiatives underway to help remove barriers to greater private sector involvement in highway construction, operation, and maintenance. These include workshops to provide States with resources to overcome barriers to PPP implementation; development of model legislation for States to use in drafting new or more flexible State laws and regulations; the development and launch of the PPP Web site, **http://www.fhwa.dot.gov/ppp**, which contains links to many PPP resources, both domestic and international; and case studies of how States and local governments have overcome institutional barriers to PPP implementation.

CHAPTER 14: *Executive Summary*

Freight Transportation

Freight transportation enables economic activity, and trucking is a key element of freight transportation. Trucks carried 70 percent of the value and 60 percent of the tons of commodities shipped in 2002, not including shipments moved by truck in combination with another mode.

Trucking is both a critical component of the Nation's economy and a concern to the traveling public, who share increasingly crowded highways with freight-hauling vehicles. Commercial truck travel doubled over the past two decades. On one-fifth of the mileage of the Interstate Highway System, trucks account for more than 30 percent of all vehicles. Truck travel has been exceeding the growth in passenger travel over time, suggesting that the percentage of trucks in the traffic stream is likely to grow substantially if current trends continue. Freight tonnage is forecast to increase by 70 percent between 1998 and 2020, and trucking is expected to account for the majority of the projected increase.

Highway congestion affects motorists, freight carriers, and freight shippers. Shippers are affected through an increase in logistics costs made up of transportation costs, inventory costs, and order costs (involving the size and frequency of an order of goods). Slower and more unreliable transportation increases transportation costs directly, but also increases order costs and inventory costs.

A recent study for FHWA has identified over 2,000 truck bottlenecks throughout the United States, which cause more than 243 million hours of delay to truckers annually, translating into direct user costs of $7.8 billion per year. Of the four major types of bottlenecks analyzed, 227 urban freeway interchange bottlenecks accounted for an estimated 124 million truck hours of delay. Other types of bottlenecks include 859 steep grades (66 million hours of delay), 517 signalized intersections (43 million hours of delay), and 507 lane drops (11 million hours of delay).

CHAPTER 15: *Executive Summary*

Operations Strategies

Highways are traditionally viewed as transportation facilities with fixed capacity, carrying traffic that peaks with commuters twice each weekday. However, increased traffic demand does not occur just twice daily or on a predictable schedule. It can occur several times during the day and can be driven by temporary and less predictable events.

Reductions in maximum capacity caused by crashes, work zones, bad weather, and other incidents create at least as much delay as the recurring overload of traffic from commuting. This situation is especially costly to the freight transportation community and affects the economy and the American consumer.

To overcome constraints on maximum capacity and temporary capacity losses, operations strategies are a critical tool. For freeways and other major arterials, strategies include monitoring roadway conditions; detecting, verifying, responding to, and clearing incidents quickly; providing traveler information through variable message signs, 511 telephone service, and other means; implementing lane management strategies; controlling flows onto freeways with ramp meters; and restricting some facilities to high occupancy vehicles. On minor arterials and major collectors, the timing and coordination of traffic signals are essential to facilitate the flow of traffic. States and local governments are making progress in the adoption of these strategies, but much work in this area remains to be done.

Without greater attention to operations, travelers and goods moving on the Nation's highways will continue to waste many hours as a result of delay caused by recurring congestion, incidents, work zones, weather, and poor traffic control. Lives will be ruined or lost because unsafe conditions and crashes are not detected and countered in a timely fashion. Through the effective implementation of correct operations strategies, transportation system reliability, safety, and security can be improved and productivity increased.

Contacts for Additional Information

GENERAL INFORMATION

Mr. E. Ross Crichton	Team Leader
Highway Needs and Investment Analysis Team	
Office of Legislation and Governmental Affairs, FHWA	
Phone:	202-366-5027
E-mail:	ross.crichton@dot.gov

Mr. Darren Timothy	Economist
Highway Needs and Investment Analysis Team	
Office of Legislation and Governmental Affairs, FHWA	
Phone:	202-366-4051
E-mail:	darren.timothy@dot.gov

Mr. Stephen Sissel	Highway Engineer
Highway Needs and Investment Analysis Team	
Office of Legislative and Governmental Affairs, FHWA	
Phone:	202-366-5764
E-mail:	steven.sissel@dot.gov

Ms. Nancy Ody	Economist
Performance Management Division	
Office of Budget & Policy, FTA	
Phone:	202-366-0177
E-mail:	nancy.ody@dot.gov

Mr. John Giorgis	Program Analyst
Performance Management Division	
Office of Budget & Policy, FTA	
Phone:	202-366-5430
E-mail:	john.giorgis@dot.gov

Ms. Dedra Goodman	Transportation Specialist
Highway Needs and Investment Analysis Team	
Office of Legislative and Governmental Affairs, FHWA	
Phone:	202-366-6597
E-mail:	dedra.goodman@dot.gov

SPECIFIC TOPICS

Chapter 1	Darren Timothy, FHWA* and Nancy Ody, FTA*
Chapter 2	Stephen Sissel, FHWA* and John Giorgis, FTA*
Chapter 3	Stephen Sissel, FHWA* and Nancy Ody, FTA*
Chapter 4	Stephen Sissel, FHWA* and John Giorgis, FTA*
Chapter 5	Dedra Goodman, FHWA* and John Giorgis, FTA*
Chapter 6	Dedra Goodman, FHWA* and Nancy Ody, FTA*
Chapter 7	Darren Timothy, FHWA* and Nancy Ody, FTA*
Chapter 8	Darren Timothy, FHWA* and Nancy Ody, FTA*
Chapter 9	Darren Timothy, FHWA* and Nancy Ody, FTA*
Chapter 10	Darren Timothy, FHWA* and Nancy Ody, FTA*
Chapter 11	Stephen Sissel, FHWA* and Darren Timothy, FHWA*
Chapter 12	Stephen Sissel, FHWA* and Darren Timothy, FHWA*
Chapter 13	Dedra Goodman, FHWA*
Chapter 14	Joanne Sedor, FHWA 202-366-8959, Joanne.Sedor@dot.gov Rolf Schmitt, FHWA: 202-366-9258, Rolf.Schmitt@dot.gov
Chapter 15	Stephen Sissel, FHWA*
Afterword	Darren Timothy, FHWA*
Appendix A	Darren Timothy, FHWA*
Appendix B	Stephen Sissel, FHWA*
Appendix C	Nancy Ody, FTA*

* See General Information above for contact information.

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